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TITLE: Suggestive selling in a customer self-ordering system

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INVENTOR-INFORMATION:

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PARENT-CASE:
CROSS REFERENCE TO RELATED APPLICATION This is a division of application Ser. No. 07/436,605, filed Nov. 15, 1989, now U.S. Pat. No. 5,235,509, which is a continuation-in-part application of U.S. patent application Ser. No. 07/373,381 filed on Jun. 28, 1989 now abandoned.

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PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected | Search ALL

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4179643	January 1983	Homma et al.	395/140
☐	4547851	October 1985	Kurland	364/401
☐	4703423	October 1987	Bado et al.	364/400
☐	4775935	October 1988	Yourick	364/401
☐	5077607	December 1991	Johnson et al.	358/86

ART-UNIT: 231

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ABSTRACT:

A customer self ordering system is provided for a retail sales store that reduces labor costs, increases efficiency, facilitates managerial tasks and improves customer service. The system provides one or more clusters, each of which is usually operated by a single employee. At least two customer ordering terminals are included with each cluster. A customer enters an order by manipulating a touch screen at each customer ordering terminal. Software for running the customer ordering terminals is designed to be self-teaching, while the proximity of the customer terminal to a cashier terminal at the cluster permits easy customer access of employees for assistance. Terminals may be provided in order preparation areas for displaying customer orders. Additionally, the system operates several managerial subroutines, and the system can accumulate all order data quickly and efficiently for accounting purposes.

15 Claims, 28 Drawing figures

DOCUMENT-IDENTIFIER: US 5353219 A
TITLE: Suggestive selling in a customer self-ordering system

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Brief Summary Text (5):
Retail stores, such as fast food restaurants and the like, have traditionally been labor intensive industries. Employees of retail establishments have traditionally been paid at or near the minimum wage. Since chances for advancement are minimal, such stores have found it difficult to retain quality employees, and the employee turnover rate is very high. Further, given that the employees handle virtually all of the receipts and products at some point in time during the day-to-day operations of such stores, and managers cannot watch all of the employees all of the time, employee theft is a very serious problem.

Brief Summary Text (7):
To further complicate the above situation, demographics indicate that the labor pool for such service oriented industries is shrinking, while at the same time the demand for employees in the service industries is ever increasing. However, since the cost of technology has been decreasing, applications of technology to service industries has been on the rise. This is evidenced by the use of automatic teller machines in the banking industry, automatic fare card machines in public transportation systems, automated security systems to supplement or replace guards in the private security industry, etc. However, the marriage of high technology and retail sales outlets has been slow in coming. This is in part due to public resistance to anything new, to anything perceived as not easy to use, understand or dehumanizing, and to computers in general. Additionally, the costs involved with such systems, the human factor in having such systems relate to employees and having employees capable of interfacing with such devices, and the flexibility that such devices would need in order to be able to respond to the day to day changes in the retail world have yet to be addressed.

Brief Summary Text (11):
Like the Kurland patent, the Lucero patent fails to address many factors that must be taken into consideration when designing an interactive ordering system. Simplicity of design, customer assistance issues, and system flexibility are simply not addressed. Further, beyond its basic function, the Lucero patent does not aid in the overall running of the restaurant. Clearly, a computer-based system is needed that will not simply reduce labor costs without addressing other problems. The system must not alienate customers, while at the same time have flexibility and improve the day to day operations and oversight of a retail store.

Brief Summary Text (14):
Software is included for operating the above-described system so that when a customer inputs an order from one of the customer ordering terminals, the order is displayed at the associated cashier terminal. Selected items can be displayed at the cashier terminal instantaneous with when the items are selected by the customer, when the customer changes menu screens, or when the customer has finished ordering. A running total and list of items ordered is displayed at the customer ordering terminal during ordering, and at the end of ordering, the processor automatically calculates the total amount of the order and displays the total amount due at both the customer ordering terminal and the interactive cashier terminal. After a cashier inputs the amount of money tendered by the customer, the processor displays the amount due and calculates and displays the change due at both the cashier and

customer terminals. If two customer orders are being input at one time, the cashier can manipulate the cashier terminal so that one or both of the orders are selectively displayed.

Brief Summary Text (15):
The present invention also provides a method for automatically calculating the effect of a coupon on the amount due for a customer order. Either a coupon identification code is input by the cashier or a bar code reader is used to read a bar code on the coupon to obtain the coupon identification code. The processor accesses stored data corresponding to the coupon identification code, checks the order to make sure that an item for which the coupon is valid has been ordered, and calculates the discount to be taken and recalculates the total due. Error messages are displayed if the customer order does not include a valid item, or the coupon has expired or is not valid on the day or at the time of day it is presented.

Detailed Description Text (3):
In a traditional retail or fast food establishment in which employees prepare or collect ordered items, a customer approaches a counter and verbally places his or her order with an employee. The employee either writes down the order, or enters the order into some type of ordering system by pressing the appropriate places on a keypad of some type or entering the appropriate codes into the ordering system. Accordingly, there is a one to one correspondence between each individual customer that is ordering and each counter employee. Additionally, as the order is verbally communicated to the counter employee, it is common for the employee to mistakenly enter the order into the ordering system or write down the order incorrectly. Worse yet, the employee may not enter the order at all, and simply not charge the customer or pocket the money paid by the customer. As there is no record of the transaction made, such theft is difficult to catch or prove. In the situation where the order is written down, the order must usually be communicated to other store employees for filling of the order, and further miscommunication is possible. When the order is entered into an ordering system by the employee, the order may or may not be electronically communicated to other store employees. In either case, both the customer and the store must rely on the employee to properly enter, add, calculate or total the order, collect the proper amount of money and make the proper change. The customer can almost never be sure that he or she has received the proper items or was charged the proper price until after the transaction is completed. Usually only at this time can the customer inspect the items he or she received and/or inspect the receipt, which may or may not include enough information to sufficiently inform the customer about each individual item included in his or her purchase.

Detailed Description Text (4):
The present invention seeks to overcome these problem areas and reduce labor costs at the same time, while assuring customer satisfaction.

Detailed Description Text (5):
As discussed above, the present invention has applications in many types of retail sales operations, particularly those in which orders are prepared or gathered in employee areas, such as fast food restaurants, catalog showrooms, auto part stores, etc. The following description will be made in reference to an application in a fast food restaurant. It will be appreciated by those skilled in the art that by providing slight modifications to the configuration of the present invention and the operating software described below, the present invention can be easily adapted for use in many different retail areas.

Detailed Description Text (6):
In FIG. 1, a basic cluster 10 according to the present invention is illustrated. One major advantage of the present invention is that the system is designed on the modular concept. A single system in operation in a retail sales environment can consist of a single cluster 10 having a minimum of peripheral devices included therein, or a plurality of attached clusters 10 having additional devices attached thereto, as will be explained later. This permits both relatively low start-up costs and future expansion.

Detailed Description Text (8):
Customer terminals 14, 16 are provided in each cluster 10, the customer terminals being controlled by the processor 12. The key to labor savings is that the customer inputs his or her own order through one of the customer terminals 14, 16. For optimum employee efficiency, at least two such customer terminals should be included in each cluster 10. Each cluster 10 can be operated by a single employee who

operates a cashier terminal 18, which can display at least one of the customer orders as it is being entered by the customer. Thus, while previously one employee could only take an order from one customer at a time, with the present invention two customers (or more if a cluster includes more than two customer terminals) can be inputting orders at a time. In the meantime, the employee is free to gather the ordered items as they are being ordered. In this way, customer throughput speed is increased while fewer employees are needed.

Detailed Description Text (14):
In the preferred embodiment, the cluster 10 also includes an additional monitor situated in close proximity to the cashier monitor 28. This additional monitor is defined as a runner monitor 34, which allows the store employee stationed at the cashier terminal 18 to monitor incoming orders from both of the customer terminals 14, 16 at the same time by using the runner monitor 34 and the cashier monitor 28. It is in this way that the labor savings and the efficiency of the present invention are magnified. With the store employee being free from having to take orders from customers who are having difficulty or are taking a long time in deciding what to order, the store employee is free to fill orders for two customers as they are being input into the respective customer terminals 14, 16 and then obtain payment and make change for the customer who finishes first.

Detailed Description Text (15):
It is not necessary that the runner monitor 34 be able to perform all the system functions due to its proximity to the cashier terminal 18. The runner monitor 34 is preferably monochrome, and is attached to the processor 12 over a conventional cable through a monochrome card (not shown) in the processor 12. The customer order or orders being displayed on the runner monitor 34 can be changed by a bump bar 36 associated therewith. The bump bar 36 is connected to the processor 12 over a bump bar cable which connects to a bump bar card (not shown) in the processor 12. The bump bar 36 is shown in more detail in FIG. 2. The runner monitor 34 usually displays one or more customer orders as they are being received from the customer terminals 14, 16. The bump bar 36 enables the store employee to control which order is being displayed on the runner monitor 34. As illustrated in FIG. 2, the bump bar 36 will generally include only four buttons. While two or more orders may be displayed on the runner terminal 34 at one time, for simplicity, one of the orders will be surrounded by a box. When the store employee has filled this order, by hitting a "done" button 38 on the bump bar 36, the box will be shifted to surround an unfilled order, if any. A "previous" button 40 is used to recall the previous order, and is useful when a previous order has been removed from the monitor 34 by the processor 12. Similarly, a "next" button 42 will cause the next sequential order input into one of the customer terminals 14, 16 to be displayed on the runner monitor 34. A "first" button 42 allows the first order input into the cluster 10 during a predetermined time period since the cluster 10 was initialized to be recalled from the hard disk of the processor 12 and displayed on the runner monitor 34.

Detailed Description Text (18):
The hard disk (not shown) of the processor 12 stores customer order data as it is input. Alternatively, customer data can be stored in non volatile RAM. Loss of data stored in this way due to power outages is prevented by an electrical back-up system, which can run the overall system for a short period of time. This time allows a store manager to save data onto more permanent storage media and shut down the system in an orderly manner, if necessary. Reports regarding the sales for the cluster 10 can be generated using this data. Further, the hard disk can store a variety of programs for not only running the cluster 10 but aiding in the overall operation of the retail establishment. Accordingly, a single cluster 10 can be configured and act as an entire customer input point of sale system. However, in applications which have heavy customer traffic and require more than two customer stations, it is more effective to use a plurality of clusters 10. For this reason, two ports in the serial card of each processor 12 are reserved for the input and output of data to other clusters or computers.

Detailed Description Text (21):
Further, the system can perform a time clock function, or process data from each cluster when a cashier terminal is being used by an employee to clock in or clock out. In this way, an employee can clock in at any cluster 10, the data being sent to the consolidator 50. Thus, an employee cannot clock in twice at two different clusters 10. Additionally, the employee work schedule can be stored by the system. This can prevent employees from clocking in early and clocking out late, or having

others clock them in early and/or out late, in order to gain credit for additional time worked. For example, if an employee tries to punch in early or punch out late, the system can refuse to allow the entry without manager approval. The consolidator 50 keeps track of the hours worked by each employee for payroll and generate reports therefor as needed.

Detailed Description Text (24):
Depending on the configuration, a cluster 10, consolidator 50 or manager workstation 60 can be used to generate daily, weekly and/or monthly reports. These reports can indicate total sales, sales breakdowns, labor reports, inventory, etc. The information included in such reports can also be used to prepare future work schedules, order new inventory, etc.

Detailed Description Text (25):
Another option is that one or more preparation terminals 70 can be run off the consolidator 50 in accordance with the specific needs of the retail establishment. If the retail establishment sells only a single product line, like many fast food restaurants, the preparation terminal 70 can consist of a display only which lists the required items to be collected or prepared. Alternatively, the preparation terminal 70 may consist of a monitor and a bump bar so that individual orders can be displayed together for collection or preparation.

Detailed Description Text (26):
If more than one preparation site exists, or different preparation sites are required for different product lines, two or more preparation terminals 70 may be required, witch the consolidator 50 sending the appropriate orders or portions thereof to the appropriate preparation terminals 70, or the consolidator 50 splitting the orders between preparation terminals 70 so that the preparation terminal with the least backlog receives the next order to be processed. Alternatively, all of this information can be sent to a dedicated preparation processor, which can then split up the work between individual preparation terminals 70 as required. The preparation terminals 70 can be programmed to instruct employees to prepare items which take a relatively long time to prepare. Such items include fried chicken, roast beef, etc., and such decisions can be based on the time of day, day of the week, weather, time of year, past selling history, etc.

Detailed Description Text (34):
Alternatively, in areas in which multiple languages are commonly used, the first screen displayed by the processor 12 at the customer terminal may have a number of boxes, each in a different language, each instructing the customer to touch it to begin the order if the customer wishes the following screens to use the language of that box. Alternatively, the language selection screen may appear on the second screen (step 104). After the customer has selected the box indicating his or her choice of language in step 106, the processor 12 will display future screens using the language selected by the customer (step 108). This is accomplished by accessing a portion of memory having stored therein the symbols corresponding to the language selected for the display screens. Language selection at one terminal does not affect the language in use at any of the other terminals. Further, any of the other terminals in the system can use any available language. This is especially useful in case a store employee speaks or is more familiar with a language other than English, and can help to reduce training time and costs in such instances.

Detailed Description Text (35):
The next display screen to be displayed has two boxes, and asks the customer if he or she will be dining in the restaurant or taking his order out (step 110), as illustrated in FIG. 6. This display serves two purposes. First, as there are only two boxes and the request is quite clear, the customer becomes further acquainted with the concept of touching the boxes to communicate his or her order. Second, the order will now be tagged appropriately in case the ordered products are to be packaged differently for dining in versus taking out. After the customer inputs the dining location information by selecting the appropriate box (step 112), the system stores this information (step 114). At this time the system will display a primary menu screen (step 116), as illustrated in step 116 of FIG. 4B, and begin actual ordering.

Detailed Description Text (36):
A number of different requirements need to be satisfied in designing the primary menu screen. First of all, the size of the selection boxes must be considered. The boxes must be of sufficient size to display within their boundaries an easily

readable written description of the selection they represent, and be of sufficient size so as to be easily discernible and selectable by a customer so that the customer cannot easily touch a neighboring box when attempting to touch a first box. Research by human factors engineers have found that a minimum size for such boxes for customer interaction is 3/4" square. Additionally, in the preferred embodiment, a video receipt is also displayed on the customer monitor in addition to the boxes. The video receipt indicates which items the customer has selected at any point of time during ordering. In this way, the customer knows that an action he or she has taken has elicited a response from the system. This gives the customer a feeling of control, increases the customer's comfort level, and continues the self-teaching aspect of the system. The video receipt may or may not include the price of the ordered items and a total for all of the items ordered at any given time.

Detailed Description Text (40):
The customer indicates that he or she has finished ordering by selecting the "finish ordering" box (step 138). At this time, the processor 12 may optionally cause a suggestive selling-subroutine to be entered (FIG. 4C, step 140), which will be explained later. When the suggestive selling subroutine ends, or if no suggestive subroutine is included in the system, a "total screen" is displayed on the customer monitor, itemizing the items ordered and the total amount due (step 142). At this time customer interaction with the system is completed, and the system no longer accepts input from the customer touch screen.

Detailed Description Text (42):
In the event the customer tenders a coupon or is eligible for a discount, the system must be able to process this information. Appropriate subroutines are provided for processing the coupon or discount and, if necessary, recalculating the total amount due for the order. Upon selection of one of the coupon or discount boxes (step 152), the processor 12 accesses the appropriate subroutine (step 154). A more complete coupon subroutine is discussed below. The discount is automatically calculated and applied to the order, the video receipt being updated appropriately. If any additional coupon or discount is presented or requested, the subroutine makes sure that the additional coupon or discount is valid with any coupon or discount already taken (step 156). After all changes to the order have been processed, the employee selects the "amount tendered" box, which causes an appropriate screen having numbers to be displayed at the cashier terminal for entry of the amount tendered. Upon entry of this amount, the processor 12 calculates the change due and both the customer monitor (FIG. 9) and the cashier monitor display a final video receipt, which shows the amount tendered and change due (step 158). The cashier then closes out the order, and causes a receipt to be printed by selecting the proper box, if so requested. After a predetermined period of time or upon the cashier's initiation, the customer monitor stops displaying the final video receipt and returns to the "start order" screen (step 160). A new order may then be entered by the next customer.

Detailed Description Text (46):
Additionally, as described above, a "help" box is displayed on the customer monitor during the ordering process. Thus, a help subroutine may be accessed during ordering, as illustrated by the flowchart of FIG. 10A. When a customer selects the help box (step 202), the processor 12 causes an informational screen pertinent to the present step being taken by the customer in the ordering process to be displayed (step 204). Information relating to the display screen, which the customer was viewing before selecting the "help" box in step 202, will be displayed, as well as general information regarding how the overall system functions. Also displayed on the help screen are at least "return to order" and "call employee" function boxes. If the customer selects the "return to order" box, the processor 12 will return to the point in the order that existed before the customer selected the help option. By selecting the "call employee" box (step 206), the processor 12 will cause an alert to appear on the cashier monitor (step 208). Optionally, whenever the help screen has been displayed for a predetermined period of time (step 207), indicating that the customer is confused or does not understand the system or the help information, the cashier will also be alerted.

Detailed Description Text (47):
Similarly, if during the ordering process (step 200) the customer does not initiate the help option, but does not input any selections into the customer terminal for a predetermined period of time (step 210), once again indicating the possibility of customer confusion, an alert can be displayed at the corresponding cashier monitor informing the cashier of a possible problem (step 208). Thus, customer assistance

can be provided upon customer initiative or lack of customer input to the system. In this way, the overall system is designed to be extremely responsive to the needs of the customer.

Detailed Description Text (50):
Another important feature of the present invention is the automated suggestive selling aspect. In a traditional fast food environment, after the customer has verbally presented his or her order to a store employee, the store employee is instructed to suggest items to the customer which the customer may not have ordered, such as drinks, desserts, etc. Suggestive selling is performed in order to increase sales and profits, as these items are usually high profit items. Therefore, even if only a relatively small percentage of the suggestive selling pitches are accepted by a customer, the return is high for the amount of time involved suggesting these items. Therefore, it will be preferable to include some type of suggestive selling subroutine into any point of sale system.

Detailed Description Text (57):
Certain limitations can be placed on the suggestive selling subroutine. For example, a limit may be placed on the number of items suggestively sold. Additionally, once the customer has selected a suggested item, the subroutine may end. At any time the subroutine may be disabled or the categories to be suggested or their order of importance can be changed.

Detailed Description Text (59):
A flow chart for a special order subroutine is illustrated in FIG. 13. The special order subroutine can be entered out of the main subroutine by the customer, or, if special orders are not to be encouraged, can be entered only by a cashier at the cashier terminal. This special order subroutine is extremely flexible, and can be used at any time during the ordering.

Detailed Description Text (63):
FIG. 14 illustrates a subroutine to be accessed if a customer presents a coupon to the cashier. The processor 12 is able to process a wide variety of coupons, such as cents off coupons, two-for-one coupons, buy one get one free coupons, etc. The processor 12 automatically checks if there is a coupon limit on the number of items for which a coupon can be applied, or if the coupon is valid at the time it is presented, or if the coupon is valid with any other type of discount already taken. A typical subroutine for a coupon is discussed below.

Detailed Description Text (64):
When presented with a coupon, the cashier selects a "coupon discount" box on the cashier terminal (step 330). At this time, the processor 12 displays a query on the cashier terminal for a coupon number. If available, the cashier may use the bar code scanner to scan a bar code on the coupon, or enter a coupon number which may be printed on the coupon or noted on a coupon list, separate from the computer, provided to the cashier. When the coupon is finally identified, the processor 12 accesses stored coupon data for the coupon (step 332). The processor 12 checks whether the coupon has expired, whether the coupon is valid on the present day, and whether the coupon is valid at the present time of day (step 334). If not, an error message is displayed, and the processor 12 will return to the main program (step 336). Alternatively, an override may be built into the system which allows the discount provided on the coupon to be entered at the discretion of the cashier, or at the discretion of the manager (by requiring that the manager enter a code to override the rejection of the coupon). The processor 12 then checks to see if items for which the coupon is valid have been ordered (step 338). If not, an error message is displayed and the processor 12 returns to the main program (step 340). If an item for which the coupon is valid has been selected, the number of correct items is counted (step 342). If, for example., the coupon provides for a discount on roast beef sandwiches up to a maximum of four roast beef sandwiches, but six roast beef sandwiches have been selected by the customer (and counted in step 342), the "count" will be changed from six to four (the coupon limit), so that a discount will only be given on four of the six roast beef sandwiches in the order (steps 344, 346). In step 348, the processor 12 checks to see if a discount on the roast beef sandwiches is valid with any other discounts already taken. If not, an error message will be displayed and the processor will cause the coupon subroutine to end and return to the main program (step 350). If no other discount has been taken or if the present coupon is valid with a discount already taken, the discount will be calculated, applied to the order and displayed on the video receipt (step 352). The processor 12 then returns to the main program.

Detailed Description Text (68):
Accordingly, in an ongoing subroutine, this initial amount is stored by the processor 12 (step 360). Upon selection of the amount tendered box by the cashier after the entry of each order, the amount of the order is added to the stored amount, and this new amount is stored (step 362). The system can call for a skim at this time for one of two reasons. The system may call for a manager's skim after a passage of a predetermined period of time, or when a certain amount of cash has built upon the cash drawer. Thus, when the "amount tendered" box is entered and the predetermined period of time has passed since the previous skim or the initialization of the cashier terminal (step 364), or the stored amount of cash expected to be at the station is greater than a predetermined dollar limit (step 366), a skim message is displayed on the cashier monitor (step 368). If a manager work station is provided in the system, this message may also be displayed at the manager workstation so as to inform him. The message displayed at either the cashier terminal or the manager workstation may or may not include an amount to be skimmed from the cash drawer. The message to the cashier can be either informative or annoying in nature to catch the cashier's attention, so that the cashier will inform the manager that a skim is necessary as soon as possible. The skim message can be set to expire after a predetermined period of time, or can be terminated by the cashier by selection of a box on the cashier terminal and may tell the manager how much cash should be skimmed. The skim message will reappear each subsequent time the "amount tendered" box is selected by the cashier if no skim is performed after the message is initially displayed, and the amount of each subsequent order added to the running total. If a skim is performed (step 370), the manager inputs the amount of money skimmed from the cash drawer. The amount of money skimmed is subtracted from the running total, and the time period restarted in anticipation of the next skim.

Detailed Description Text (74):
Another manager assistance tool is the "drop" subroutine, as illustrated in the flow chart of FIG. 19. The drop subroutine is related to the skim subroutine and the drawer count subroutine, in that every time a skim or a drawer count is performed, the skim or drawer count is added to a running drop total (steps 430, 432). The drop subroutine is actually entered when the manager selects a "drop" box from the control screen (step 434). This portion of the control screen can be displayed on any or all of the cashier terminal, the consolidator terminal, and the manager workstation terminal, depending on the configuration.

Detailed Description Text (75):
Generally speaking, a "drop" is the placement of cash into a store safe for inclusion in a future deposit to a bank. Accordingly, there are many factors which the manager must weigh before deciding how much money he or she would like to include in the drop, such as the need for change, any upcoming cash expenditures, etc. Accordingly, after selecting the drop option, the manager enters the amount to be dropped (step 436). The processor 12 can cause the running drop amount to be displayed, together with each individual addition to the running drop amount since the last drop occurred. The manager enters the amount of cash he or she decides to drop into the safe (step 436) and this entered amount is subtracted from the running drop amount (step 438). The amount of the drop is added to a running deposit amount (step 440), which will be explained below. Each subsequent skim or drawer count is added to the new drop amount, in anticipation of the next drop.

Detailed Description Text (84):
A flowchart for a second group ordering subroutine is illustrated in FIG. 23. For this method to be operative, the system should include a consolidator, as this method provides the flexibility of allowing individual members of the group to order from any customer terminal. The consolidator is necessary to collect order data from the various clusters. Further, more than one group at a time may order.

Detailed Description Text (85):
In the second group ordering method, a cashier or manager must input into the system that a group is present. This accomplished by manipulation of a touch screen at one of the cashier terminals (step 500). Then, as individual orders are input to any customer terminal and each order is displayed and filled at the associated cashier terminal (steps 502 and 504), the individual group members must inform the cashier that the order is part of the group order at the time the customer would normally pay (step 506). If the customer is not a member of the group, the transaction is completed in the usual way (step 508). If the customer is a member of the group, no money is collected from the customer, and the customer's order data is added to

accumulated group data for the group (step 510). Group data is accumulated until it is determined that all the members of the group have finished ordering (step 512). The group totals are then calculated for the group (step 514) in a manner similar to that for the first group ordering method, and payment is received from the paying member of the group.

Detailed Description Text (86):
In addition, more than one group may be accommodated at a time. In step 500, multiple groups can be designated when the group ordering option is first initiated. Alternatively, as indicated by steps 516 and 518, new groups can be designated while other groups are being accommodated. After each group is paid for, and the processor 12 determines whether any further groups remain (step 520). If no further groups remain, the second group ordering subroutine ends.

Current US Original Classification (1):
705/16

CLAIMS:

1. A method for suggestive selling among a plurality of food items, comprising:

providing processing means and a computer terminal having a display screen;

establishing priority among a plurality of food items that are to be suggested for possible purchase by 1 customer, said plurality of food items including at least a first food item category and a second food item category different from said first food item category, said first food item category being one of sandwiches, fries, drinks and desserts and said second food item category being another one of sandwiches, fries, drinks and desserts, each of said first food item category and said second food item category being represented on said display screen using separate menu indicia and, for each of said first and second food item categories, first and second food indicia, respectively, represent food items thereof;

obtaining a first customer order of one or more food items using said processing means by displaying firstly said first food indicia representative of food items of said first category on said display screen while said display screen is free of said second food indicia;

determining using said processing means that an input was received indicating that the first customer order was finished after at least one food item of said first category of food items was ordered;

comparing the first customer order with said first category of said food items using said processing means;

providing suggestive selling indicia for said second category of food items to the customer using said computer terminal display screen, independently of which one of said sandwiches, fries, drinks and desserts is said first food item category, when at least one food item of said first category is selected by the customer; and

displaying secondly, using said computer terminal display screen, said second food indicia separately from and not at the same time as said first food indicia, said displaying of said second food indicia being an initial display thereof on said display screen in connection with the first customer order and in which said displaying of said second food indicia occurs before any displaying of only said menu indicia representative of said first and second food item categories in connection with the first customer order.

5. A method, as claimed in claim 3, wherein:

a plurality of said menu indicia are displayed on said display screen of said computer terminal at the same time said affirmative and reaction indicators are displayed.

13. An apparatus, as claimed in claim 9, wherein:

said second display is a first time said second food indicia of said second food item category is displayed to the customer during the first customer order.

10/027364

WEST Search History

DATE: Monday, October 13, 2003

Set Name side by side	Query	Hit Count	Set Name result set
DB=PGPB,JPAB,EPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR			
L5	(((tim$ or duration or interval) with (cook$ or prepar$)) with food) and (predict$ or forecast$ or future) and @pd<=19970527	5	L5
DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR			
L4	L3 and (tim$ or duration or interval)	9	L4
L3	l1 and L2	9	L3
L2	((705/7 |705/8 |705/9 |705/10 |705/15 |705/16 |705/22 |705/28 |705/29)!.CCLS.)	1998	L2
L1	((cook$ or prepar$) with food) and (predict$ or forecast$ or future) and @ad<=19970527	1710	L1

END OF SEARCH HISTORY

Generate Collection | Print

L5: Entry 1 of 5 File: EPAB Dec 29, 1988

PUB-NO: GB002206222A
DOCUMENT-IDENTIFIER: GB 2206222 A
TITLE: Controlling cooking time

PUBN-DATE: December 29, 1988

INVENTOR-INFORMATION:

NAME	COUNTRY
HAWLEY, ARTHUR DEREK	

US-CL-CURRENT: 219/712
INT-CL (IPC): H05B 6/68
EUR-CL (EPC): F24C003/12; H05B006/68

ABSTRACT:

In a cooking oven 1 in which the output of a food probe 2 inserted in a food item 3 is compared with a preset temperature to determine when the food item is cooked, there is provided means such as a microprocessor 7 to predict the time at which the food will be cooked. Repeated measurements are made of the food probe temperature to estimate when the pre-set temperature will be reached. This information is used to control the cooking means 5 to finish the cooking at a preset end time programmed in by the user.

L5: Entry 2 of 5 File: EPAB Oct 12, 1988

PUB-NO: GB002203320A
DOCUMENT-IDENTIFIER: GB 2203320 A
TITLE: Cooking ovens

PUBN-DATE: October 12, 1988

INVENTOR-INFORMATION:
NAME COUNTRY
RICHARDS, JOHN

ASSIGNEE-INFORMATION:
NAME COUNTRY
CREDA LTD

APPL-NO: GB08808213
APPL-DATE: April 8, 1988

PRIORITY-DATA: GB08708405A (April 8, 1987)

US-CL-CURRENT: 219/712
INT-CL (IPC): H05B 6/68; F24C 7/02; F24C 7/08
EUR-CL (EPC): H05B006/68

ABSTRACT:

In a cooking oven 1 in which the output of a food probe 2 inserted in a food item 3 is compared with a preset temperature to determine when the food item is cooked, there is provided means such as a microprocessor 6 to predict the time at which the food will be cooked. Repeated measurements are made of the food probe temperature to estimate when the pre-set temperature will be reached. The predicted cooking time may be displayed continuously or on demand. The oven may be a gas, electric, microwave or combined microwave/fanned convection oven.

L5: Entry 3 of 5 File: DWPI Dec 29, 1988

DERWENT-ACC-NO: 1989-001797
DERWENT-WEEK: 198901

TITLE: Controlling cooking time using food probe - makes repeated measurements of food probe temp. to estimate when pre-set temp. will be reached

INVENTOR: HAWLEY, A D

PATENT-ASSIGNEE: CREDA LTD (CREDN)

PRIORITY-DATA: 1987GB-0008406 (April 8, 1987), 1988GB-0008214 (April 8, 1988)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
GB 2206222 A	December 29, 1988		011	
GB 2206222 B	November 21, 1990		000	

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
GB 2206222A	April 8, 1988	1988GB-0008214	

INT-CL (IPC): H05B 6/68

ABSTRACTED-PUB-NO: GB 2206222A
BASIC-ABSTRACT:

The cooking oven comprises a food probe for insertion in a food item to be cooked and for affording an output indicative of its temperature. A cooker causes the food item to be cooked and the output of the food probe is compared with a preset temperature for determining when the food item is cooked. A timer presets a required time at which the food item is to be cooked. A circuit operable in conjunction with the output of the probe controls the cooker whereby the time at which the food item is cooked corresponds to the preset time. A processor determines the rate of temperature rise of the food probe predicting the time at which the food item will be cooked and for controlling the cooker whereby the predicted time corresponds to the preset time.

USE - Microwave ovens, combination microwave/anned convection ovens or gas and electric ovens.

ABSTRACTED-PUB-NO: GB 2206222B
EQUIVALENT-ABSTRACTS:

The cooking oven comprises a food probe for insertion in a food item to be cooked and for affording an output indicative of its temperature. A cooker causes the food item to be cooked and the output of the food probe is compared with a preset temperature for determining when the food item is cooked. A timer presets a required time at which the food item is to be cooked. A circuit operable in conjunction with the output of the probe controls the cooker whereby the time at which the food item is cooked corresponds to the preset time. A processor determines the rate of temperature rise of the food probe predicting the time at which the food item will be cooked and for controlling the cooker whereby the predicted time corresponds to the preset time.

USE - Microwave ovens, combination microwave/anned convection ovens or gas and electric ovens.

CHOSEN-DRAWING: Dwg.0/4 Dwg.0/4

DERWENT-CLASS: X25 X27
EPI-CODES: X25-B04; X27-C09;

L5: Entry 4 of 5 File: DWPI Oct 12, 1988

DERWENT-ACC-NO: 1988-288058
DERWENT-WEEK: 198841

TITLE: Electric, gas or microwave cooking oven - has microprocessor predicting time at which food will be cooked depending on food probe temp.

INVENTOR: RICHARDS, J

PATENT-ASSIGNEE: CREDA LTD (CREDN)

PRIORITY-DATA: 1987GB-0008405 (April 8, 1987), 1988GB-0008213 (April 8, 1988)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
GB 2203320 A	October 12, 1988		010	
GB 2203320 B	May 8, 1991		000	

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
GB 2203320A	April 8, 1988	1988GB-0008213	

INT-CL (IPC): F24C 7/02; H05B 6/68

ABSTRACTED-PUB-NO: GB 2203320A
BASIC-ABSTRACT:

The output of a food probe inserted in a food item is compared with a preset temperature to determine when the food item is cooked. A microprocessor predicts the time at which the food will be cooked. Repeated measurements are made of the probe temperature to estimate when the pre-set temperature will be reached. The predicted cooking time may be displayed continuously or on demand.

The second derivative of the variation of probe temperature with respect to time is measured in which the processor determines the rate of temperature rise of the probe after a peak has occurred in the second derivative. The processor is arranged to repeatedly predict the time at which the food item will be cooked.

ADVANTAGE - Provides good indication of time at which cooking will be completed.

ABSTRACTED-PUB-NO: GB 2203320B
EQUIVALENT-ABSTRACTS:

A cooking oven comprising a food probe for insertion in a food item to be cooked and for affording an output indicative of the temperature thereof, means for comparing, after a peak has occurred in the second derivative of the output of the food probe with respect to time, the output of the food probe with a preset temperature for determining when said food item is cooked, and means operable on the output of the food probe for predicting the time at which said food item will be cooked.

CHOSEN-DRAWING: Dwg.0/4

DERWENT-CLASS: Q74 X25 X27
EPI-CODES: X25-B04; X27-C09;

End of Result Set

Generate Collection | Print

L5: Entry 5 of 5 File: DWPI Jan 22, 1986

DERWENT-ACC-NO: 1986-022677
DERWENT-WEEK: 198604

TITLE: Microwave oven with fan and electrical heating element - simultaneously applies microwave power and hot air to cavity and controls cooking time as function of variation of hot air temp.

INVENTOR: EKE, K I

PATENT-ASSIGNEE: MICROWAVE OVENS LTD (MICRN)

PRIORITY-DATA: 1984GB-0017644 (July 11, 1984)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
EP 169000 A	January 22, 1986	E	019	
AU 8544505 A	January 16, 1986		000	
CA 1236174 A	May 3, 1988		000	
DE 3570513 G	June 29, 1989		000	
EP 169000 B	May 24, 1989	E	000	
US 4647746 A	March 3, 1987		000	

DESIGNATED-STATES: BE DE FR GB IT SE BE DE FR GB IT SE

CITED-DOCUMENTS:A3...198749; EP 122710 ; EP 23971 ; FR 2510239 ; GB 2124408 ; No-SR.Pub

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
EP 169000A	June 28, 1985	1985EP-0304652	
US 4647746A	July 8, 1985	1985US-0752592	

INT-CL (IPC): F24C 7/08; H05B 6/68

ABSTRACTED-PUB-NO: EP 169000A
BASIC-ABSTRACT:

A triac (14) controls the supply of power to a caVity lamp (16) and blower (18) which cools the magnetron. A convection timer controls a second triac (20) which passes current to a third triac (22) and a convection motor (24) which drives a fan to blow air over an electrical resistance heater (32). The resulting flow of hot air is forced through the oven cavity and produces browning of the food being cooked by microwave power supplied to the cavity.

A thermistor, provided in the hot air flow following its passage over the resistance heater, senses the gradient of the temperature-time curve. Temperature readings are taken at a predetermined interval, say four minutes from cold, and a microcomputer calculates the gradient. The time to reach a temperature of 250 degrees Celsius is predicted and is set to turn off the oven.

ADVANTAGE - Gradient of hot air temperature curve is characteristic of foodstuff being cooked, and is used to predict accurately when that foodstuff will be done.

ABSTRACTED-PUB-NO: EP 169000B
EQUIVALENT-ABSTRACTS:

A microwave oven comprising a microwave generator for supplying microwave power to a cavity of the oven, thermal heating means for supplying a forced flow of hot air to the cavity simultaneously with the microwave power, means for monitoring the variation in hot air temperature with time, means for sensing said variation after a predetermined time interval short in comparison with the time taken to cook food items in the oven, and processing means responsive to the sensing means for predicting the time at which the hot air temperature will reach a particular threshold, and means for discontinuing the supply of power to the microwave generator and the thermal heating means after the predicted time has elapsed. (10pp)

US 4647746A

The microwave oven has a magnetron for supplying microwave power to a cavity of the oven, and an electrical resistance heating element over which air is blown by a fan to provide a forced flow of hot air through the cavity. The variation in hot air temp. is monitored, and the slope of the temp./time variation is sensed after a predetermined time interval from the commencement of cooking with the oven in a cold condition.

The sensed slope is then used to predict the time period it will take the hot air temp. to reach a predetermined threshold, and the microwave power and the hot air are discontinued after the predicted time period has elapsed. (9pp)p

CHOSEN-DRAWING: Dwg.1/5

DERWENT-CLASS: Q74 X27
EPI-CODES: X27-C01;

Your wildcard search against 10000 terms has yielded the results below.

Your result set for the last L# is incomplete.

The probable cause is use of unlimited truncation. Revise your search strategy to use limited truncation.

Generate Collection | Print

Search Results - Record(s) 1 through 5 of 5 returned.

☐ 1. Document ID: GB 2206222 A

L5: Entry 1 of 5 File: EPAB Dec 29, 1988

PUB-NO: GB002206222A
DOCUMENT-IDENTIFIER: GB 2206222 A
TITLE: Controlling cooking time

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw. Desc | Image

☐ 2. Document ID: GB 2203320 A

L5: Entry 2 of 5 File: EPAB Oct 12, 1988

PUB-NO: GB002203320A
DOCUMENT-IDENTIFIER: GB 2203320 A
TITLE: Cooking ovens

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw. Desc | Image

☐ 3. Document ID: GB 2206222 A GB 2206222 B

L5: Entry 3 of 5 File: DWPI Dec 29, 1988

DERWENT-ACC-NO: 1989-001797
DERWENT-WEEK: 198901

TITLE: Controlling cooking time using food probe - makes repeated measurements of food probe temp. to estimate when pre-set temp. will be reached

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw. Desc | Image

☐ 4. Document ID: GB 2203320 A GB 2203320 B

L5: Entry 4 of 5 File: DWPI Oct 12, 1988

DERWENT-ACC-NO: 1988-288058
DERWENT-WEEK: 198841
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TITLE: Electric, gas or microwave cooking oven - has microprocessor predicting time at which food will be cooked depending on food probe temp.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw. Desc | Image

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☐ 5. Document ID: EP 169000 A AU 8544505 A CA 1236174 A DE 3570513 G EP 169000 B US 4647746 A

L5: Entry 5 of 5 File: DWPI Jan 22, 1986

DERWENT-ACC-NO: 1986-022677
DERWENT-WEEK: 198604
COPYRIGHT 2003 DERWENT INFORMATION LTD

TITLE: Microwave oven with fan and electrical heating element - simultaneously applies microwave power and hot air to cavity and controls cooking time as function of variation of hot air temp.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw. Desc | Image

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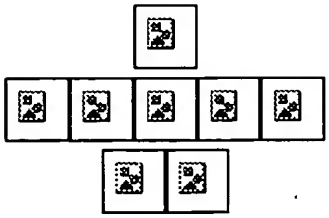
Terms	Documents
(((tim$ or duration or interval) with (cook$ or prepar$)) with food) and (predict$ or forecast$ or future) and @pd<=19970527	5

Display Format: - Change Format

Previous Page Next Page



Searching 1976 to present...

Results of Search in 1976 to present db for:
((((inventory AND restaurant) AND interval) AND (predict OR forecast)) AND food): 11 patents.
Hits 1 through 11 out of 11

Jump To

Refine Search | inventory AND restaurant AND interval AND (predict

	PAT. NO.		Title
1	6,516,302		Method and system for accumulating marginal discounts and applying an associated incentive upon achieving one of a plurality of thresholds
2	6,473,084		Prediction input
3	6,424,949		Method and system for selective incentive point-of-sale marketing in response to customer shopping histories
4	6,377,935		Method and system for selective incentive point-of-sale marketing in response to customer shopping histories
5	6,334,108		Method and system for selective incentive point-of-sale marketing in response to customer shopping histories
6	6,189,736		Condiment dispensing apparatus
7	6,112,181		Systems and methods for matching, selecting, narrowcasting, and/or classifying based on rights management and/or other information
8	6,026,372		Computer system for maintaining current and predicting future food needs
9	5,712,985		System and method for estimating business demand based on business influences

10 5,630,070  Optimization of manufacturing resource planning

11 5,227,874  Method for measuring the effectiveness of stimuli on decisions of shoppers

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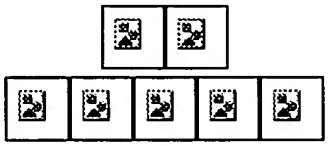

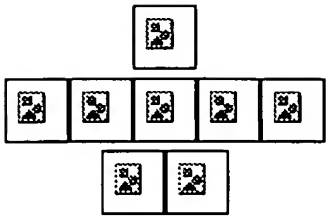

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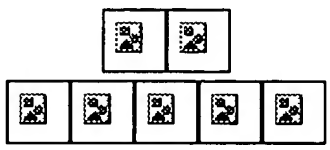
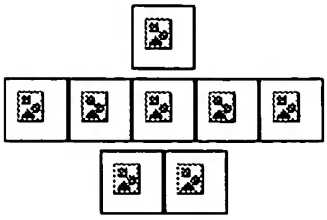
((((inventory AND cook) AND interval) AND (predict OR forecast)) AND food): 7 patents.
Hits 1 through 7 out of 7

Jump To

Refine Search | inventory AND cook AND interval AND (predict OR

	PAT. NO.		Title
1	6,491,217		Machine readable label reader system with versatile response selection
2	6,479,258		Non-stochastic generation of genetic vaccines
3	6,132,724		Allelic polygene diagnosis of reward deficiency syndrome and treatment
4	6,112,181		Systems and methods for matching, selecting, narrowcasting, and/or classifying based on rights management and/or other information
5	6,026,372		Computer system for maintaining current and predicting future food needs
6	5,630,070		Optimization of manufacturing resource planning
7	5,550,021		Allelic diagnosis of susceptibility to compulsive disorder





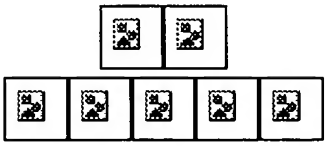
Searching 1976 to present...

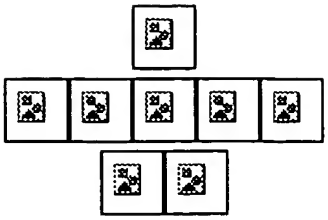
Results of Search in 1976 to present db for:
(((cook? AND food) AND "time interval") AND database): 2 patents.
Hits 1 through 2 out of 2

Jump To

Refine Search cook? AND food AND

PAT. NO.		Title
1	6,381,614	Recipe database that integrates menus for food preparation of multiple dishes based on skill level
2	5,331,575	Shortening management system





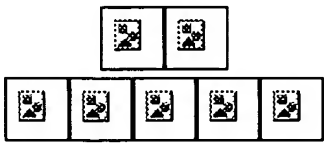
Searching 1976 to present...

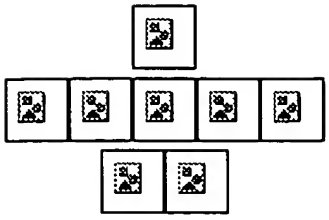
Results of Search in 1976 to present db for:
((food AND "cooking time") AND (predict? OR forecast?)): 5 patents.
Hits 1 through 5 out of 5

Jump To

Refine Search food AND

	PAT. NO.		Title
1	6,170,318		Methods of use for sensor based fluid detection devices
2	6,026,372		Computer system for maintaining current and predicting future food needs
3	5,663,484		Basmati rice lines and grains
4	4,972,059		Method and apparatus for adjusting the temperature profile of food products during microwave heating
5	4,647,746		Microwave ovens and methods of cooking food





Searching 1976 to present...

Results of Search in 1976 to present db for:
((((inventory AND restaurant) AND interval) AND (predict OR forecast)) AND food): 11 patents.
Hits 1 through 11 out of 11

Jump To

Refine Search | inventory AND restaurant AND interval AND (predict

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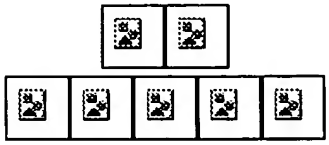

4 article(s) related to: **+(predic OR forecast) +food +inventory +"cooking time"**

General Electric Tuesday Technology Brief - 11 April 2000.
1. GE Appliances Launches Culinary Web Site
From PR Newswire, April 11 2000
Page(s): 3

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A family changed their diet to be low in fat, high in carbohydrates and almost entirely vegetarian. They did it gradually and allowed for exceptions so...
From Better Homes & Gardens, March 01 1995 by Candace Manroe, Kristi Fuller
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GE Appliances Reveals Consumer Benefits of Concept Smart Appliances.
CHICAGO, April 6 /PRNewswire/ --
From PR Newswire, April 06 2000
Page(s): 1

Canning olives the Musco way: Musco Family Olive ramps up with sophisticated canning lines that meet the growing demand for its Pearls oilves. Updated...
Canning olives the Musco way: Musco Family Olive ramps up with sophisticated canning lines that meet the growing demand for its Pearls oilves. Updated...
From Packaging Digest, February 01 2002 by Lauren R. Hartman
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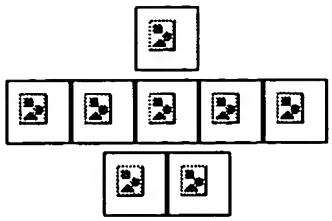

Searching 1976 to present...

Results of Search in 1976 to present db for:
((((inventory AND restaurant) AND interval) AND (predict OR forecast)) AND food): 11 patents.
Hits 1 through 11 out of 11

Jump To

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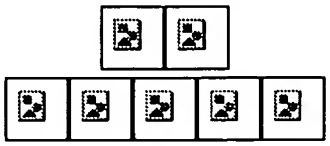

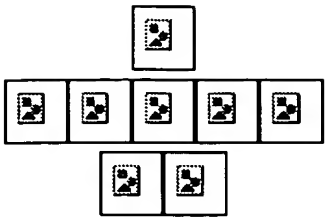

Searching 1976 to present...

Results of Search in 1976 to present db for:
((food AND "cooking time") AND (predict? OR forecast?)): 5 patents.
Hits 1 through 5 out of 5

Jump To

Refine Search food AND

	PAT. NO.		Title
1	6,170,318		Methods of use for sensor based fluid detection devices
2	6,026,372		Computer system for maintaining current and predicting future food needs
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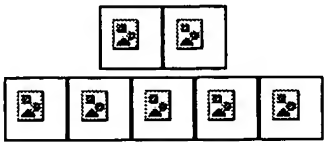

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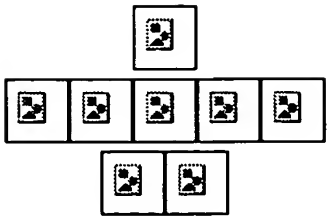
From Packaging Digest, February 01 2002 by Lauren R. Hartman
Page(s): 5



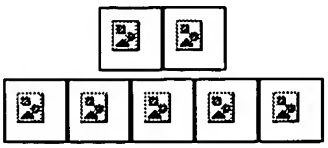
Searching 1976 to present...

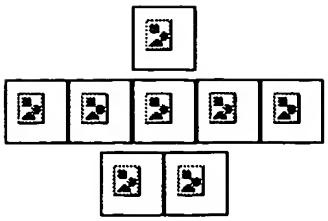
Results of Search in 1976 to present db for:
((((inventory AND cook) AND interval) AND (predict OR forecast)) AND food): 7 patents.
Hits 1 through 7 out of 7

Jump To

Refine Search | inventory AND cook AND interval AND (predict OR

	PAT. NO.	Title
1	6,491,217	Machine readable label reader system with versatile response selection
2	6,479,258	Non-stochastic generation of genetic vaccines
3	6,132,724	Allelic polygene diagnosis of reward deficiency syndrome and treatment
4	6,112,181	Systems and methods for matching, selecting, narrowcasting, and/or classifying based on rights management and/or other information
5	6,026,372	Computer system for maintaining current and predicting future food needs
6	5,630,070	Optimization of manufacturing resource planning
7	5,550,021	Allelic diagnosis of susceptibility to compulsive disorder





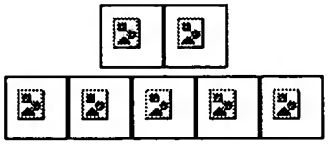
Searching 1976 to present...

Results of Search in 1976 to present db for:
(((cook? AND food) AND "time interval") AND database): 2 patents.
Hits 1 through 2 out of 2

Jump To

Refine Search cook? AND food AND

	PAT. NO.		Title
1	6,381,614		Recipe database that integrates menus for food preparation of multiple dishes based on skill level
2	5,331,575		Shortening management system



Your wildcard search against 10000 terms has yielded the results below.

Your result set for the last L# is incomplete.

The probable cause is use of unlimited truncation. Revise your search strategy to use limited truncation.

Generate Collection | Print

Search Results - Record(s) 1 through 9 of 9 returned.

☐ 1. Document ID: US 6026372 A

L4: Entry 1 of 9 File: USPT Feb 15, 2000

US-PAT-NO: 6026372
DOCUMENT-IDENTIFIER: US 6026372 A

TITLE: Computer system for maintaining current and predicting future food needs

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Image

☐ 2. Document ID: US 5737227 A

L4: Entry 2 of 9 File: USPT Apr 7, 1998

US-PAT-NO: 5737227
DOCUMENT-IDENTIFIER: US 5737227 A

TITLE: Software planning program for coatings

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Image

☐ 3. Document ID: US 5712985 A

L4: Entry 3 of 9 File: USPT Jan 27, 1998

US-PAT-NO: 5712985
DOCUMENT-IDENTIFIER: US 5712985 A

TITLE: System and method for estimating business demand based on business influences

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Image

☐ 4. Document ID: US 5630070 A

L4: Entry 4 of 9 File: USPT May 13, 1997

US-PAT-NO: 5630070
DOCUMENT-IDENTIFIER: US 5630070 A

TITLE: Optimization of manufacturing resource planning

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC
Draw. Desc | Image

☐ 5. Document ID: US 5541394 A

L4: Entry 5 of 9 File: USPT Jul 30, 1996

US-PAT-NO: 5541394
DOCUMENT-IDENTIFIER: US 5541394 A
**** See image for Certificate of Correction ****

TITLE: Delivery service management system

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw. Desc | Image

☐ 6. Document ID: US 5357426 A

L4: Entry 6 of 9 File: USPT Oct 18, 1994

US-PAT-NO: 5357426
DOCUMENT-IDENTIFIER: US 5357426 A

TITLE: Programmable apparatus for storing displaying and serving food and drink

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw. Desc | Image

☐ 7. Document ID: US 5353219 A

L4: Entry 7 of 9 File: USPT Oct 4, 1994

US-PAT-NO: 5353219
DOCUMENT-IDENTIFIER: US 5353219 A

TITLE: Suggestive selling in a customer self-ordering system

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw. Desc | Image

☐ 8. Document ID: US 5262938 A

L4: Entry 8 of 9 File: USPT Nov 16, 1993

US-PAT-NO: 5262938
DOCUMENT-IDENTIFIER: US 5262938 A

TITLE: Food services routing system including seating location display

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Drawi Desc | Image | KWIC

☐ 9. Document ID: US 5235509 A

L4: Entry 9 of 9 File: USPT Aug 10, 1993

US-PAT-NO: 5235509
DOCUMENT-IDENTIFIER: US 5235509 A

TITLE: Customer self-ordering system using information displayed on a screen

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Drawi Desc | Image | KWIC

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Terms	Documents
L3 and (tim$ or duration or interval)	9

Display Format: TI | Change Format

Previous Page Next Page

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L4: Entry 1 of 9 File: USPT Feb 15, 2000

US-PAT-NO: 6026372
DOCUMENT-IDENTIFIER: US 6026372 A

TITLE: Computer system for maintaining current and predicting future food needs

DATE-ISSUED: February 15, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Savage; John K.	Decatur	GA	30030	

APPL-NO: 08/ 863000 [PALM]
DATE FILED: May 27, 1997

INT-CL: [07] G06 F 19/00, G06 F 17/30

US-CL-ISSUED: 705/15; 705/20, 705/22, 705/28, 705/29
US-CL-CURRENT: 705/15; 705/20, 705/22, 705/28, 705/29

FIELD-OF-SEARCH: 705/15, 705/20, 705/22, 705/28, 705/29, 99/468, 99/486, 99/325, 99/332, 99/327, 99/326, 99/335, 99/342, 219/702, 426/523

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected | Search ALL

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4388689	June 1983	Hayman et al.	705/15
☐	4530067	July 1985	Dorr	705/15
☐	4569421	February 1986	Sandstedt	186/39
☐	4922435	May 1990	Cahlander et al.	700/247
☐	5003472	March 1991	Perrill et al.	705/15
☐	5128862	July 1992	Mueller	705/15
☐	5132914	July 1992	Cahlander et al.	700/211
☐	5218527	June 1993	Ishikawa et al.	705/15
☐	5253564	October 1993	Rosenbrock et al.	99/328
☐	5357426	October 1994	Morita et al.	700/90
☐	5504589	April 1996	Montague et al.	358/403
☐	5510979	April 1996	Moderi et al.	705/18
☐	5553312	September 1996	Gattey et al.	455/11.1
☐	5616269	April 1997	Fowler et al.	219/720
☐	5653906	August 1997	Fowler et al.	219/716
☐	5812393	September 1998	Drucker	700/15

ART-UNIT: 274

PRIMARY-EXAMINER: Trammell; James P.

ASSISTANT-EXAMINER: Nguyen; Cuong H.

ATTY-AGENT-FIRM: Kennedy, Davis & Hodge, LLP

ABSTRACT:

A computer system (10) is provided which includes an electronic cash registers (11) electronically coupled to a cooking station monitor (12) and input (13), and a manager's station monitor (15), input (16), and printer (17). The system instructs the cook to initiate a cooking process in response to the number of items on hand and items currently being cooked in view of the number of items typically desired to have on hand at a particular time of the day.

13 Claims, 4 Drawing figures

DOCUMENT-IDENTIFIER: US 5712985 A
TITLE: System and method for estimating business demand based on business influences

Abstract Text (1):
A demand forecasting and production scheduling system and method creates production schedules for various business items describing a forecasted demand for the business items in a number of future time intervals. The system includes a computer managed database of various profiles, including a base profile for each business item, and a number of influence profiles. The profiles describe variations in demand for the business item in a number of time intervals. The base profile describes an underlying level of demand for a business item that is anticipated for the business item absent any influencing factors, such as promotional sales, holidays, weather variations, and the like. The variations in demand for the business item due to such influence factors are stored in the database as influence profiles. The influence profiles may be either standard, percentage, or seasonal. The forecasted demand for a business item in a number of future time intervals is determined by selective combination of the base profile for the business item and any number of influence profiles. The forecasted demand is stored in the database in a forecast profile. From the forecast profile a production schedule is created, and the business item provided according to the production schedule. Actual demand for the business item is monitored and stored. The variation between actual demand and the forecasted demand is used to update the base and influence profiles. From the updated base and influence profiles the forecasted demand is redetermined, and the production schedule updated accordingly.

Application Filing Date (1):
19951013

Brief Summary Text (5):
This invention relates generally to systems and methods for analyzing and predicting business demand based on historical demand and changes in actual current demand, and more particularly, to systems and methods that predict demand on the basis of combinations of numerous influence factors.

Brief Summary Text (7):
A typical business, such as a retail business, will offer various products for sale, such as foodstuffs, consumer goods, or the like. This type of business will attempt to supply its products in timely response to consumer demand. More generally, any business will require a series of various tasks, the number and timing of which depend on changes in demand for the business's offerings. In production planning for the business environment then, a tendency exists toward using production plans that are calculated on an infrequent basis. This basis is often daily at best, and it typically is based on average daily or weekly sales. This type of production planning results in excessive product and waste where demand is below production, or lost revenue where there is not enough production to meet customer demand. It is impractical, if not impossible, for a human being to calculate business demand on a more frequent basis such as hourly or every fifteen minutes, which would be more suited to determining varying business demand levels during daily operations.

Brief Summary Text (8):
In addition to the impracticality of computing business demand manually on a more frequent basis is the complexity introduced by different demand patterns for each day of the week, seasons of the year, or other recurring events, or due to other influencing factors. Customer foot traffic and product preferences are unique to each day of the week, and each week of the year. These traffic patterns and

preferences are further complicated by seasonal trends that may span many weeks throughout the year. In addition, promotional programs, local events, holidays, and the like, all influence the demand levels faced by a business. Other events, such as limited sales events, influence demand in time periods less than a week or a day. Accommodating this level of complexity requires storing and using the past business demand according to a model that accounts for the influencing factor, such as the season, or day of the week, or other events or condition, as they occur in various time intervals during the business day. The model should cover each of a plurality of products or business items to determine future business demand for a specific location.

Brief Summary Text (9):
Another difficulty encountered once the past business demand has been stored is the ability to deal with incomplete data from current time periods and to compare trends in just-completed time intervals against projected demand in the equal time intervals in order to adjust the production or business item in near-future time intervals accurately and with confidence. One method for making such comparisons and projections on other near-future intervals is to take a simple positive or negative percentage of the trend of just-completed periods against projected periods and apply it to the remaining projected near future periods for the day. This method is unreliable given the many anomalies that can occur, for example, when variations in the weather cause more (or less) customers to patronize the business. Other methods which rely on historical demand to project future demand with such trend based analysis merely updates the projected demand in the future intervals based on the recent variations between projected demand and actual demand. However, such systems do not use these recent variations to change the data that was used to project demand in the first place, thereby failing to capture the variations in demand as they occur for use in subsequent forecasting.

Brief Summary Text (10):
The system and methods described in the related application employ an analysis of demand based on a business day model, and provide a useful and practical way of forecasting demand for products for a given business day. However, one limitation of the day model analysis is that the basic unit of modeling is a business day, so that all events that influence demand on a given day are assumed to influence demand throughout the entire day to some degree.

Brief Summary Text (11):
Because of the structure of that model, the day model less efficiently captures in a single model entity events or conditions that influence demand on either longer time scales, such as seasonal changes, or smaller time scales, such as temporary events (e.g. mid-day sales), changing weather conditions, or the presence or absence of a particular employee or other production resource for part of the business day. For example, individual day models may be created for a rain day and a Monday, and applied when its raining on Monday morning. However, if the rain stops, the combined profile for the day still forecasts demand based on a rain day model. Similarly, a day model is not advantageously used to determine if the number of staff on duty is an efficient number for the level of demand.

Brief Summary Text (14):
The present invention provides a system and method for analyzing business demand which incorporates tracking of past business demand for a plurality of products or tasks, time intervals during the day, and providing improved projection of business demand for such items. The system of the present invention uses the concept of a business influence to aggregate, store, access, and manipulate demand data for the purpose of forecasting future demand levels for one or more business items, using computer based data analysis and production management. A business influence is any type of quantifiable factor that produces a variation in demand for some type of business item.

Brief Summary Text (15):
The business influences model is composed of three distinct entities: a base profile, at least one influence profile, and a forecast profile. The base profile, influence profiles, and forecast profiles are data storage structures that persistently maintain their associated profile information in selected files in a database managed by a computer processor. The profiles are time-demand curves where demand is represented as either quantity or percentage units.

Brief Summary Text (16):

For each business item, a base profile in a base profile file is established using actual demand quantities from a sales data file containing sales data for the business item. The business item may be actual retail items, internal resources or production materials, raw goods, complex or simple tasks, or labor resources, such as employees. The base profile reflects the demand for a business item absent any known influences, such as the weather, sales, holidays, the season, or the like. The base profile can extend over a business day, or over a smaller or greater time period, and the data can be stored in any number of time intervals within the time period.

Brief Summary Text (17):
An influence profile reflects the changes in demand for a business item due to a particular identifiable condition, such as the weather, or a sale, or the like. Influence profiles are selected and combined with the base profile to create a forecast profile. The base profile and influence profiles are demand curves representing a particular level of demand for a business item in each of the number of time intervals. Influence profiles may be either standard, meaning the value of change is represented in units, or percentage, meaning that the value of change is represented in percentage terms. Seasonality influence profiles may also be created to represent the influence of long term seasonal influences.

Brief Summary Text (18):
The forecast profile is a projection of anticipated demand for a business item based on its base profile and any selected influence profiles or seasonality profiles, for a selected period. The selected period may be any useful time period, such as a business quarter, month, week, day, hour, minute, and so forth. In order to project demand then, a base profile for a selected business item is combined with any number of influence profiles to create a forecast profile. The forecast profile indicates the quantity of a business item to be produced, supplied, scheduled, or otherwise provided in each of the time intervals included in the base profile. The business item is then provided in the forecasted quantities in each of the time intervals.

Brief Summary Text (19):
Actual demand for the business item is then monitored and recorded. After the forecast period, the underlying base profile and influence profiles that were used to create the forecast profile are updated to reflect the difference between the forecasted profile amount and the actual demand, according to the degree or weighting that the various profiles (base or influence) contributed to the forecasted profile. A future forecast profile will then more accurately predict the future demand because it is based on both historical demand and recent variations in actual demand from the historical base levels.

Brief Summary Text (20):
The present invention thereby overcomes the limitations of prior art systems by correctly allocating between the percentage influence profiles and the standard and base profiles the amount of error that these profiles contributed forecasted profiles, and within each type of profile, standard or percentage, allocating to each its relative contribution to the error in a self correcting and stabilized manner. This increases the accuracy of subsequent forecasts since the base profile and influence profiles on which the forecast profile is made are updated to reflect the correctly allocated demand variations.

Brief Summary Text (21):
The present invention further provides a powerful analytical tool for determining what factors influence demand and by how significant the factors are over specific time intervals. This benefit arises where the user defines influence profiles without specifying the data values to be used in the profile. The forecasting process of the present invention adaptively determines the data values over time. This allows the business to subsequently review the defined influence profile to determine the impact, if any, the specified influence or factor has on business demand.

Drawing Description Text (5):
FIG. 4 is a data flow diagram of the data transformation during the forecasting process;

Detailed Description Text (3):
Referring now to FIG. 1, there is shown a block schematic diagram of a system 100 configured in accordance with one embodiment of the present invention to provide

improved demand projection and production scheduling for a plurality of business items. Business items can include any type of trackable, quantifiable product or service that a business produces or consumes. Business items include products, services, or resources for sale or internal use in the further production of other products or services. For example, business items include not only the retail products that a store offers, but also its staffing requirements, the quantity or costs of raw materials and supplies, and production tasks involved in producing its products, such as discrete manufacturing steps, restocking inventory, ordering more supplies, and the like. Any production task which has an identifiable starting point, duration, and frequency can be evaluated by the system.

Detailed Description Text (5):
In accordance with the present invention, database 127 contains a number of files for gathering, storing, and manipulating data relating to demand for business items and the production and scheduling used to supply business items in response to such demand. Database 127 includes a base profile file 22, a sales data file 34, an actual demand data file 15, a sales definition file 32, a forecast profile file 24, an influence profile file 26, a business day model file 30, and an influence group file 28.

Detailed Description Text (6):
The files in database 127 are accessed and modified under control of the CPU 111 in response to routines 125 such as author base profiles and influence profiles 301, create forecast profile 303, monitor actual demand 305, and update profiles 307, as described later herein, for controlling the display on display device 113 of directions to a user for projecting quantities and schedules for business items to be produced by the user during the prescribed time intervals throughout the day.

Detailed Description Text (8):
FIG. 2 shows a transactional dataflow diagram of the process of projecting future business demand levels for a plurality of business items based on historical demand data, projected total future demand, and current demand levels.

Detailed Description Text (9):
The user authors 201 a plurality of base profiles and influence profiles that describe the relationships between the business items, time intervals, and actual demand data. The base profiles and the influence profiles are drawn from an analysis of actual demand data in the actual demand data file. 15 which stores the demand for the item on an interval basis. The user may additionally chose to author variables describing production capacity and staffing requirements of the business location, along with other location specific or relevant production variables.

Detailed Description Text (10):
The user selects a business item to be produced or scheduled during some time interval. The selection of a business item, and subsequent forecasting may be repeated for multiple business items. The user selects a base profile for the business item and any number of influence profiles. In a preferred embodiment the business item is associated in the system 100 with a base profile, and selected influence profiles, so that selection of the business item results in automatic selection of the profiles. In a preferred embodiment, each business day is associated with at least one base profile and influence profile that captures the variations in demand patterns which effect each demand for a business item associated with the base profile. The system 100 creates 203 a forecast profile from the selected base and influence profiles. The forecast profile indicates the actual quantity of the business item that the user should produce, schedule, or Otherwise provide, in each of the projected intervals covered by the forecast profile.

Detailed Description Text (11):
The user then schedules and produces 205 the business item according to the forecast profile. The user may employ conventional scheduling procedures to produce the business item, since most business items or tasks cannot be produced instantly, but rather require a certain amount of time to complete. The system 100 may provide such scheduling procedures, and assist in the production process, such as the determination of a task schedule, or the computer aided control of production, or the like.

Detailed Description Text (12):
The system 100 monitors 207 the actual demand for the business item, preferably storing data for such demand for the business item in each of the time intervals

corresponding to the base profile in the actual demand data file 15. This actual demand data for a business item is used to update 209 the base profile, and the influence profiles associated with the business item. In the preferred embodiment, these profiles are updated 209 after the completion of the forecast period. Alternatively, the profiles may be updated 209 during the forecast period. Future forecast profiles will then be made 203 using the updated base and influence profiles.

Detailed Description Text (15):
A base profile for each business item to be forecasted is stored in a data base 127 in the base profile file 22. In Appendix A, base profile file 22 is named "base.sub.-- profile." In the preferred embodiment, the base profile stores a historical exponentially smoothed average of actual demand for the item in each of a variable number of time intervals. In alternative embodiments, the base profile stores a moving average of actual, a forward trend average, or other types of historical averages.

Detailed Description Text (20):
a set of data values which are the historical, exponentially smoothed values in each time interval of the base profile.

Detailed Description Text (22):
A base profile covers any number and length of the time intervals that are capable of being modeled, rather than merely a single day. Accordingly, in a preferred embodiment, the base profile further includes attributes to describe the relevant time-related features:

Detailed Description Text (23):
a time value specifying the start of the first time interval of the base profile. This value is used to indicate to what part of a business day the base profile is to apply. For example, a base profile for modeling increased business during the evening dinner hours can be specified to begin at 5:00pm in the afternoon;

Detailed Description Text (24):
a time interval value specifying the length of each time interval in the base profile. This allows different base profiles to have varying time interval lengths, as may be appropriate to the type of entity, event, or condition being modeled. For example, for a relatively slow selling item a longer interval value may be appropriate, or for a high volume item, a very short interval may be appropriate to capture rapid fluctuations in demand; and

Detailed Description Text (25):
a number of periods value specifying the number of time intervals included in the base profile.

Detailed Description Text (30):
This base profile describes a bakery product at the retail fast food establishment. The category of "bakery" is useful to allow categorization, subtotaling, and other accounting uses for determining total sales, counts, and the like. The item id is useful to distinguish this particular item and base profile from others in the same category. The business item is macadamia nut cookies, a consumable, perishable good. The weighting factor is 0.28, meaning that when the base profile data is updated, 28% of the updated value will come from the actual demand data received during a monitored time interval, and 72% will come from the base profile itself prior to the update. The last time the profile was updated was Dec. 30, 1995. The base profile begins for time intervals starting at 11:00am, which may be the hour the business opens, or any other start time. The length of each time interval is 900 seconds or 15 minutes. The short period length is useful because the time required to make the cookies is relatively short, and the demand for them may change dramatically over relatively short intervals, such as in the four 15 minute intervals during the typical lunch hour.

Detailed Description Text (31):
The period flag indicates that the number of time intervals in the profile, and hence, number of entries in the data extension. A period flag of "1" indicates that the intervals are to be mapped to the open business hours. Thus, the number of time intervals will be the number of seconds in the open hours, divided by 900, the specified period length. The demand for the cookies is stored in terms of actual units of cookies, as opposed to kilograms, or dollar value of cookies sold. The data

extension is thus interpreted in light of the fo oing attributes, and represents a base level of demand of 23 cookies demanded between 11:00am and 11:15am, 25 cookies demanded between 11:15am and 11:30am, and so on, until the close of business, when only 1 cookie was demanded in the last 15 minute interval.

Detailed Description Text (33):
Here, the base profile is for a hair salon, and so the category is "hair care" services. The particular business item is a men's haircut, which is not a good, but rather a service performed. The weighting factor of 0.50 indicates that 50% of the updated base profile will come from the existing values in the base profile and 50% will come from actual demand experienced in a forecasted so period. The start time is 9:00am. The period length is 1 hour, since demand for haircuts fluctuates more slowly than cookies, or because the business does not need any finer grained forecasting. The period flag again maps to the open business hours, which may be 9:00am to 7:00pm. The units here are dollars, that is, the sales value of the haircuts in each interval. The data extension then shows the sales of haircuts throughout the business day, from 9:00am to 7:00pm.

Detailed Description Text (34):
The base profiles, as described, provide storage structures for tracking and updating a base level of demand for a given item. In order to develop forecasts for an item resulting from specific events, conditions, seasons, or other business influences, the base profile for an item is combined with any number of selected influence profiles. There are three types of influence profiles: standard influence profiles, percentage influence profiles, and seasonality influence profiles. A standard influence profile describes quantity changes to be applied to the base profile. Percent influence profiles describe percent changes to be applied to a base profile. The influence profiles are stored in database 127 in an influence profile file 26. Appendix A includes the preferred database definition of the influence profile file 26 as file "influence.sub.-- profile." FIG. 3 illustrates the association between the base profile file 22 and the influence profile file 26.

Detailed Description Text (35):
The influence profiles have some of the same attributes described above for the base profiles, specifically, the weighting factor (for updating the influence profile), the last update date, the starting time interval, the length of time interval, the unit type, and the data values. In addition, each influence profile includes an attribute that identifies the base profile in base profile file 22 to which the influence profile applies. In preferred embodiment, this attribute may be a foreign key to an identifier attribute of a base profile or the like. In addition, an influence profile may be applied to any base, regardless of the category type. FIG. 3 illustrates this in that a given influence profile may apply to any number of base profiles.

Detailed Description Text (36):
For example, a standard influence profile to describe the impact of rain conditions on demand for an item that is tracked by units would indicate an increase or decrease in the number of items in each time interval of the base profile. Here is an instance of one such influence profile, which indicates the influence of rain on the demand for cookies:

Detailed Description Text (39):
which describes a 45% decrease in a first time interval, a 15% decrease in the second time interval, a 10% decrease in the third time interval, and so on, in subsequent time intervals.

Detailed Description Text (40):
Finally, the other remaining type of influence profile is a seasonality influence profile. The seasonality influence profile is used to adjust the forecast profile for a business item for the lag time that is typically present in systems that use exponential averaging. In a preferred embodiment, the seasonality influence profile has a starting date value which indicates the beginning of the season, and either a length value, preferably in days, or an ending date value. In either case, the seasonality influence profile is applied to those forecast profiles that are created during the applicable time period. The seasonality influence profile is also stored in the influence profile file 26.

Detailed Description Text (41):
The foregoing examples are illustrative of the basic idea of the base profile, and

show that the base profile, as well as the influence and forecast profiles, are used to represent demand experienced by a business for actual goods or services, or similar business items over a selected number of time intervals.

Detailed Description Text (44):
As stated, a base profile is combined with one or more influence profiles to create a forecast profile of the anticipated demand for the business item. The forecasted demand is stored in a forecast profile file 24. In Appendix A, the forecast profile file 24 is "forecast.sub.-- profile." As the forecast profile reflects a future anticipated state of the base profile, the forecast profile includes attributes that associate it with a base profile, including its units, time periods, and the like, and with selected influence profiles. The forecast profile preferably includes a base profile identifier, that directly, or indirectly, associates the forecast profile with a base profile; a forecast date attribute, indicating the date that the forecast applies to; and a list of the influence profiles from the influence profile file 26 that were used to create the forecast. Additional desirable attributes include attributes to identify the starting time interval of the forecast, and the length of each interval. A data value attribute stores the forecasted demand in each time interval in the forecast profile.

Detailed Description Text (45):
Data related to the actual demand values is stored in several different files in database 127. The sales definition file 32 contains the identification and definition of each business item that the user desires to track and forecast. The sales data file 34 contains various total actual values for a given business item on a single specified date, and values for previous years performance. The periodic totals comes from the actual demand data file 15, which stores the actual demand levels for a business item in each of plurality of time intervals one a given date.

Detailed Description Text (48):
Referring again to FIG. 2, the base profile and influence profiles are authored 201 by the user to identify and describe the desired business influences that impact demand for a given business item. More particularly, the user specifies the attributes of a base profile or influence profile in the respective data base 127 files, base profile file 22 and influence profile file 26, such as the item description, unit type, beginning time interval, and the so forth.

Detailed Description Text (49):
More particularly, to author the base profile in the base profile file 22, the user specifies the identity of the business item, either through item type and item identifiers as in the preferred embodiment, or through some other mechanism that uniquely identifies a given item. The user may optionally include a description of item for future reference, particularly by other users of the system 100. The user further specifies the relevant period information, such as the time of the first interval, and the length of each interval, and the number of intervals. In the preferred embodiment, the user choose to have the system 100 automatically determine the number of intervals by dividing the operating business hours by the length specified for each interval. Alternatively, the user may manually specify the number of intervals for base profiles adapted to longer or shorter periods than a business day. The user further specifies the units of the base profile, such as counts, currency units, volume units, or mass units. The user also specifies a weighting value that determines the relative percentages for updating the base profile with the influence profiles and actual demand data. Once the relevant data for the base profile is entered, the system 100 will retrieve from the actual demand file 15 actual historical demand data for the identified item over a number of dates, and will compute the base profile data values, exponentially averaging the actual demand data over time. The data values are then stored in the base profile file 22.

Detailed Description Text (52):
Creating a Forecast Profile

Detailed Description Text (53):
The base profiles and the influence profiles are used in the process 203 of projecting, or forecasting, demand for selected business items in a selected set of time intervals through the creation of forecast profiles.

Detailed Description Text (54):
FIG. 4 shows a data flow diagram of one embodiment of a method for forecasting business demand using base profiles and influence profiles. The method will be

described with respect to forecasting for a single business item, but it is understood that the method could be applied repeatedly for any number of business items. A user selects 400 a starting date for the projected interval, and a number of days to be projected. A base profile is selected 401 for forecasting, for example, selecting the base profile of a product, such as cookies, or a resource, such as the employees, or a task, such as preparation of a product. As stated s above, the base profile specifies the demand for the business item as measured in either numerical, physical, or currency units.

Detailed Description Text (56):
A forecast profile is created and stored in the forecast profile file 24 for each base profile, as follows. The base profile and all the standard influence profiles associated with it are combined 405 at each data value to produce a base value profile. Expressed in vector notation, the data extension of the base value profile is: ##EQU1## where "std.sub.-- pro" is a standard influence profile, "base.sub.-- pro" is the base profile, j iterates over each standard influence profile, and i iterates over each data element (vector component) of the profiles, from the 0.sup.th to m.sup.th elements. Since the standard influence profile reflects the numerical change in the demand for the business item, combining the standard and base profile results in the anticipated demand just from the standard influence profiles. It is to be noted that in this equation, and all that follow, only the data attribute extension of the profiles is shown for convenience, and thus the examples are similarly limited to showing on the extension of the data attribute. Accordingly, data attribute extension of such examples would in practice be part of a completely defined profile, and interpreted and understood in light of the other attributes defined in each profile, such the item name, profile description, units of the data extension, the number of time intervals covered by the profile, the length of the time intervals, and the so on.

Detailed Description Text (60):
If no percentage influence profiles are present, then the combined standard influence profiles and base profile, the base.sub.-- value profile, is the forecast profile.

Detailed Description Text (61):
Where there are percentage influence profiles, the forecast profile is adjusted with these also. The percentage influence profiles cannot be directly combined with the base value profile because the units of the profile are different, the percentage influence profiles being expressed as percentages, the base value profile in other units, Such as mass, quantity, or currency. In the preferred embodiment, the data values in the percentage influence profiles are stored as decimals, though they may be stored in other formats as well. In Appendix A, the data values for percentage influence profiles are stored as short integers, and thus the percentage influence profiles are convened to a decimal form by dividing them by 100, for combining with the base value profile. This conversion is not shown in the equations herein. The retrieved percentage influence profiles are combined 407 into a single percent value profile, which is normalized to multiplicative values by adding 1 to each data element in the single percent value profile: ##EQU2##

Detailed Description Text (64):
The percent value profile may then be applied 409 to the base value profile to obtain a forecast profile, by multiplying each data value in the base value profile by a corresponding data value in the percent value profile: ##EQU3##

Detailed Description Text (65):
Thus with the foregoing exemplary profiles, the data attribute extension of the forecast profile is::

Detailed Description Text (66):
The forecast profile is then adjusted with any seasonality influence profiles, by retrieving 411 those seasonality influence profiles with a specific date or date ranges that match or include the date for the forecast profile as selected 400, and combining 413 the data values of the seasonality influence profile with the forecasted profile: ##EQU4##

Detailed Description Text (68):
then the adjusted forecast profile equals:

Detailed Description Text (69):

This adjusted forecast profile is stored as the forecast profile in database 127 in the forecast profile file 24, which, as indicated above includes attributes identifying the date(s) forecasted, the base profile being forecasted, the influence profiles used in forecasting, the time period of the first interval, time interval length, and forecasted values. This process may be repeated for any number of base profiles.

Detailed Description Text (70):
From the forecast profile, the system 100, via the processor 111, produces 415 a production schedule indicating the forecasted demand in each of future time intervals covered by the forecasted profile. The production schedule is preferably stored in the mass storage 123, and may be output on either the display 113, the printer 131, or both, as necessary.

Detailed Description Text (71):
Producing the Forecasted Business Items & Monitoring Actual Demand

Detailed Description Text (72):
Referring again to FIG. 2, after the forecast profiles have been obtained, and the production schedule created 415, the business items are produced 205 in accordance with the forecasted demand levels in the production schedule. Production typically requires various physical resources such as ovens, printing presses, or other machinery, or even shelf or floor space, and some amount of labor. In a retail store for example, production may mean stocking the forecasted number of business items, here retail consumer goods, on display shelves, according to the quantity of the business items forecasted, and at the various future time intervals specified in the production schedule. In such a retail store where variations in demand need only be accommodated by re-stocking, the production schedule may detail the forecasted quantities of business items for each day of the week, so that appropriate quantities may be ordered if necessary, and labor scheduled to restock inventory as necessary to meet the forecasted demand.

Detailed Description Text (73):
Likewise, for a retail store providing consumables, such as a fast food restaurant, production would include making the business items (e.g. cookies, hamburgers, tacos, and the like) in the forecasted quantities at the specified future time intervals. In this type of retail environment, demand fluctuates significantly throughout the day, and there is a need to provide the business items, which are perishable, only at or about the time when demand is forecasted. Accordingly, in this environment, the production schedule of forecasted demand is particularly useful, and would indicate in hourly, quarter-hourly, or other useful interval, the quantity forecasted for each business item offered by the establishment. In addition, the production schedule may be used interactively such an embodiment to provide employees of the business with the forecasted demand levels at some predetermined amount of time prior to the forecasted demand interval so that the business item may be produced in time to meet the forecasted demand.

Detailed Description Text (74):
In a service business, production may mean providing sufficient employees and working materials to produce the forecasted level of services. For example, a beauty salon that provides various cosmetic services may forecast the number of haircuts, permanents, nail manicures, and the like, for a given day or week, and further forecast both the number of employees needed to perform such services, and the amount of underlying materials (hair dye, shampoo, nail files etc.) needed to provide the services. The production schedule would be used in this instance to determine the proper level of staffing, ordering of supplies, and the like.

Detailed Description Text (75):
Similarly, a bank may forecast the number of deposits, transactions, loans, and the like, demanded during a given week, and use the production schedule to schedule its employees accordingly. A bank or brokerage firm may also forecast other intangible business items, such as stock prices, futures contracts, currency fluctuations, interest rates, and other financial instruments.

Detailed Description Text (76):
As the foregoing examples illustrate, production 205 is not limited to mere manufacturing of a business item. In addition, the production schedule provides a useful means of communicating the forecasted demand in the forecast profile to the employees of the business so that appropriate actions may be taken, employees

scheduled for work, materials or resources ordered, purchased, and allocated, and so on.

Detailed Description Text (77):
As the business continues to operate through the forecasted time intervals, whether it is a part of business day, an entire business day, or some longer period, actual demand for the business item is monitored 207 and stored in an appropriate data file in database 127, such as actual demand data file 15. In the preferred embodiment the actual demand data file 15 includes attributes that identify the date demand was monitored, the type or category of item, the starting point of the first time interval of actually monitored demand, the units of the demand, and the actual demand data values themselves in each of the time intervals included in the base profile. Appendix A illustrates the preferred database definition of the actual demand data file 15 as "actual.sub.-- demand."

Detailed Description Text (78):
Actual demand for items that are produced may be monitored by point of sale devices 208 that individually track demand of the business items, including total amounts, such as total quantities, volumes, or sales. Actual demand for other business items, such as production resources, labor resources, and the like, may also be monitored through appropriate measures, such as a manager entering current hours for employees, number of production resources employed, or automatically, such as through time entry systems, data acquisition systems coupled to the production resources, and the like. In any of these cases, the number, quantity, or sales of the business item is stored in the actual demand data file 15 for subsequent use in updating the base and influence profiles in their respective database files.

Detailed Description Text (79):
Updating the Base Profile, Forecast, and Influence Profiles

Detailed Description Text (80):
From the actual demand, the base profile is updated 209 to increase its accuracy when used in subsequent forecasting 203 processes. The updating process is a complex analysis that determines relative impact of the base profile, influence profiles, and currently received actual demand figures on the forecast profile, and allocates that impact to each profile in order to update it.

Detailed Description Text (81):
The updated values to the base profile are constrained by a maximum value and minimum value (max.sub.-- update, and min.sub.-- update). The maximum value prevents the base profile from being to heavily influenced by extreme values of actual demand that may result from unusual or temporary circumstances. The minimum update value is a destabilizing factor that prevents the components of the base value profile, or any other profile from remaining fixed at, or near 0, which would prevent, or impair any updating to the profile. For example, a maximum value of 0.3 and a minimum value of 0.01 specify that the data attribute extension of a base profile can change at most 30% and at least 1% in a single updating process. Other maximum and minimum update values may be specified by the user, depending on the particular application domain, and business item being tracked and forecasted.

Detailed Description Text (83):
Each base profile is updated as follows. Generally, there is a difference between the forecast profile, the level of demand that is forecasted for a business item, and the actual demand. This difference is a total error, here called the delta vector. Because the forecast demand is a function of the base profile and the influence profiles, how much the base profile contributed to the total between the forecast demand and the actual demand is determined. This is done by taking the base profile as a percentage of the combined absolute values of the base profile and the standard influence profiles. If this percentage is greater than the minimum update value, then it is multiplied by the delta vector to create a delta base profile; otherwise the delta base profile is just the minimum update value multiplied by the delta vector. This means the delta base profile will reflect the greater of the minimum update level or the amount of influence that the base value profile has on the overall combined profiles. This delta base profile is then used to update the base profile by weighting the delta base profile by the weighting factor for the base profile and combining it with the base profile.

Detailed Description Text (86):
Delta1 reflects that part of the difference between actual and forecast demand that

is less than the maximum allowed updating value. other words, this is the total error vector between the forecast demand and the actual demand, as limited by a maximum value. Each data value in the total error vector includes a first error component attributable to the base profile, a second error component attributable to the standard influence profiles, a third error component attributable to the percentage influence profiles, and a fourth error component attributable to the seasonality influence profiles. The updating process determines the magnitude of each of these components, and more particularly for each of the influence profile components, determines the contribution of each individual influence profile to the error component for that type of profile.

Detailed Description Text (94):
The impact of forecasted values on the standard influence profiles versus the impact on the percentage influence profiles is adjusted so that each is equally effected by the difference between actual and forecasted values. This is done by a balance factor chosen by the user. In the preferred embodiment, a balance factor of about 2 is chosen. In the absence of a balance factor, there may be disproportionate change in one type of profile as compared to another. In addition, the balance factor allows the correct level of impact of influence profiles on the base value profile to be determined.

Detailed Description Text (95):
Accordingly, the impact of all percentage influence profiles on the base value profile, in the units of the base value profile, in determining the forecast is determined 507 as a value modifier: ##EQU8##

Detailed Description Text (102):
This process is also applied to the influence profiles. The weighted delta profile describes the impact of each profile on the base value profile in predicting, with the forecast profile, the actual demand. The weighted delta profiles are used to update the various profiles to correctly reflect the significance of the difference between the actual demand profile and each of the profiles that contributed to the forecast profile.

Detailed Description Text (104):
This equation determines how much of the error vector between the actual demand and the forecast demand was attributable to the base profile.

Detailed Description Text (110):
In order to update the percentage profile, the weighted delta profiles for the percentage influence profiles must also be determined. The use of percentage influence profiles in addition to the standard influence profiles causes two key problems. First, there is the need to determine the relative contribution of the percentage influence profiles to the forecast profile visa vis the stand influence profiles, because standard influence profiles contribute unit values and percentage influence profiles contribute percent changes. Incorrectly dividing up the contribution results in unstable influence profiles and inaccurate subsequent forecasts. A second problems with the percentage influence profiles is that they produce a compounding effect because the unit change to the forecast is based on both the magnitude of the percentage profile itself, and the magnitude of the combined influences and the base profile used to create the forecast profile. Thus there is a variable impact on the business item forecast depending on the volume of demand for the business item. This can make the forecast very unstable, and result in widely varying and inaccurate forecasts. Accordingly, it is desirable to properly determine the relative contribution of the percentage influence profiles and to properly weight each percentage influence profile delta vector. This is done by first determining the portion of the change in forecast due to all of the percentage influence profiles. This is the total percent impact on the base value as shown in Eq 14. The relative impact of each percentage profile on the forecast s profile is then determined with respect to the total impact of the all the percentage profiles on the forecast. This is done as follows.

Detailed Description Text (121):
This update process 209 is preferably applied at the end of all time intervals specified in the base profile. Thus, for base profiles that track demand over a single day, the base profile and its influence profiles are updated after each day to which the base profile applies. If the base profile extends over a shorter or longer period, it is updated accordingly. For seasonality influence profiles that extend over many days, the profile is updated after all dates to which the influence

profile applies have passed. The delta profile for the seasonality influence profile is determined for each dates in the date range, and these delta profiles are averaged. The exponential update formula above is then applied, using the average delta profiles instead of the weighted percentage influence profiles.

Detailed Description Text (122):
The next time demand for the item tracked by the base profile is forecasted 203, the forecast is made with the updated profiles, and will more closely track the last set of actual demand data that was received. Continuing the foregoing example, the first forecast profile was:

Detailed Description Text (124):
After updating the base, standard, and percentage influence profiles, the next forecast will be:

Detailed Description Text (125):
As can be seen, this second forecast more closely reflects the last actual demand that was recorded. Subsequent production 205 of the forecasted business item is then performed as above.

Detailed Description Text (126):
As mentioned above, the data values for the influence profiles may be initially specified with null values. A business manager may choose to do this in order to determine what impact, if any, a particular influence has the demand for one or more business items. In this case, the update profiles 307 process will update the base profile using 100% of the forecast profile, and will then update the influence profile, and hence provide initial data values, by an appropriate amount, as determined by the foregoing process. This will cause the influence profile to reflect the actual influence on business demand that it has on the business item, allowing the business manager to determine the impact of the influence, as desired. This analytical technique can be used to determine the impact, or influence, of particular staff or management employees, of particular advertising programs or formats, of particular promotional events, such as sales or discounts, and so on. Those of skill in the art, and those in particular businesses, can identify numerous other factors which may be analyzed in conformity with the inventive process.
##SPC1##

Detailed Description Paragraph Equation (9):
forecast.data=[1350, 1.01, 0.95, 0.96, 0.84].

Detailed Description Paragraph Equation (21):
forecast.1.data=[1350, 1.01, 0.95, 0.96, 0.84].

Detailed Description Paragraph Equation (23):
forecast.2.data=[1200, 7.224, 3.007, 3.958, 4.5]

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CLAIMS:

1. A computer implemented production scheduling system for projecting future demand in a plurality of time intervals for at least one business item, s accounting for recurring variations in actual demand for the business item, and for scheduling production of the business item, the system comprising: a memory divided into separate files including a database comprising:

a base profile defining a base demand for the business item in each of a first plurality of time intervals;

at least one influence profile defining a variation of the base demand in each of a second plurality of time intervals;

at least one forecast profile defining in each of a plurality of future time intervals a forecasted demand for the business item as a function of a combination of the base profile and the at least one influence profile;

a data file containing actual current demand for the business item in each of a plurality of past time intervals;

a processor coupled to the memory to receive the base profile, and the at

least one influence profile and to produce therefrom at least one forecast profile forecasting demand for the business item in each of a plurality of future time intervals; the processor further updating the base profile and the at least one influence profile in each of selected past time intervals with a weighted minimum update value in each selected time interval; and

a production schedule apparatus coupled to the processor to receive a forecast profile and to produce therefrom a production schedule for the business item indicating a forecasted demand for the business item in a plurality of future time intervals.

2. The system of claim 1, wherein the weighted minimum update value is a function of:

a difference between the actual current demand and the forecasted demand, the difference bounded by a maximum and a minimum value; and,

a ratio of the combined base profile and the at least one influence profile to a combined absolute value of the base profile and a combined absolute value of the at least one influence profile.

3. The system of claim 1, wherein there is provided at least one standard influence profile having unit values, the forecast profile is determined by the equation: ##EQU19## where m is a number of time intervals in the base profile;

n is a number of standard influence profiles;

standard.sub.-- profile is a standard influence profile; and,

base.sub.-- profile is the base profile.

4. The system of claim 3, wherein there is provided at least one percentage influence profile having percentage values, the forecast profile is determined by the equation: ##EQU20## where forecast.sub.-- profile is the forecast profile; and,

percent.sub.-- profile is a percentage influence profile.

5. The system of claim 4, wherein there is provided at least one seasonality influence profile, the forecast profile is determined by the equation: ##EQU21## where season.sub.-- pro is the seasonality influence profile.

6. The system of claim 1, wherein the updated base profile is determined by the equation: ##EQU22## where base.sub.-- profile is the base profile prior to being updated;

profile.sub.-- weight is a weighting value specifying a percentage of the base profile to apply to the updated base profile; and

delta.sub.-- profile is a function of a difference between the actual current demand and the forecast profile, the difference bounded by a maximum and a minimum value for updating the base profile, and a ratio of the combined base profile and the at least one influence profile to a combined absolute value of the base profile and a combined absolute value of the at least one influence profile.

7. The system of claim 1, wherein an updated influence profile is determined by the equation: ##EQU23## where influence.sub.-- profile is an influence profile prior to being updated;

profile.sub.-- weight is a weighting value specifying a percentage of the influence profile to apply to the updated influence profile; and

delta.sub.-- profile is a function of a difference between the actual current demand and the forecast profile, the difference bounded by a maximum and a minimum value for updating the influence profile and a ratio of the influence profile to a combined absolute value of the base profile and a combined absolute value of the at least one influence profile.

8. The system of claim 6, wherein the delta profile is determined by the equation: ##EQU24## where base.sub.-- value is vector sum of the base profile and the at least one influence profile;

min.sub.-- update is the minimum value for updating the base profile;

profile.sub.-- sum is the combined absolute value of the base profile and the combined absolute value of the at least one influence profile; and,

delta is a vector based on the function of the difference between the actual current demand and the forecast profile, the difference bounded by a maximum and the minimum value for updating the base profile.

9. The system of claim 8, wherein the delta vector is equal to the vector sum of a first vector determined by the equation: ##EQU25## and a second vector determined by the equation: ##EQU26## where actual.sub.-- dem is the actual demand for the business item in vector form;

forecast is the forecast profile; and,

max.sub.-- update is the maximum value for updating the base profile.

12. The system of claim 7, wherein the delta profile is determined by the equation: ##EQU29## where std.sub.-- pro is the at least one influence profile;

min.sub.-- update is the minimum value for updating the base profile;

profile.sub.-- sum includes the combined absolute value of the base profile and the combined absolute value of the at least one influence profile; and,

delta is a vector based on the function of the difference between the actual current demand and the forecast profile, the difference bounded by a maximum and the minimum value for updating the base profile.

13. The system of claim 12, wherein the delta vector is equal to the

vector sum of a first vector determined by the equation: ##EQU30## and a second vector determined by the equation: ##EQU31## where actual.sub.-- dem is the actual demand for the business item in vector

forecast is the forecast profile; and,

max.sub.-- update is the maximum value for updating the base profile.

15. A computer implemented method of forecasting future demand for a business item, the method operable in a computer system including a memory for storing a plurality of files and procedures, comprising the steps

storing in a memory actual demand for the business item in each of a first plurality of time intervals;

storing in the memory a base profile defining a historical actual demand for the business item in each of a second plurality of time intervals;

storing in the memory at least one influence profile defining a variation in demand for the business item due to an influence factor in each of a plurality of time periods, wherein the influence profiles include at least one of a set comprised of:

a standard influence profile defining a variation in demand in a same unit value as the base profile;

a percentage influence profile describing a variation in demand in as a percent

change;

combining the base profile and selected influence profiles to produce a production schedule including a forecast profile projecting demand for the business item in a selected plurality of future time intervals;

monitoring actual demand for the business item in each of the future time intervals as such future time intervals become present or past time intervals, to create an actual demand profile; and,

updating the base profile and the selected influence profiles with respect to the actual demand profile, wherein updating comprises:

determining a total error between the actual demand and the forecast profile;

determining for the base profile a percent contribution of the base profile to the total error;

determining for each influence profile a percent contribution of the influence profile to the total error;

updating the base profile by its percent contribution to the total error; and,

updating each influence profile by its percent contribution to the total error.

16. The method of claim 15, wherein the step of updating the base profile and the selected influence profiles, comprises, for each past or present time interval, the steps of:

combining the base profile with selected influence profiles;

determining a weighted delta profile for the base profile describing the impact of the base profile on the forecast profile;

determining a weighted delta profile for each influence profile describing the impact of the influence profile on the forecast profile;

updating the base profile by its weighted delta profile, and a weighting factor associated with the base profile; and,

updating each influence by its weighted delta profile, and a weighting factor associated with the influence profile.

17. The method of claim 16, wherein the step of combining the base profile and selected influence profiles to create a forecast profile further comprises the steps of:

summing the base profile with selected standard influence profiles;

normalizing percentage influence profiles to define demand in a same unit as the base profile;

summing the normalized percentage influence profiles; and,

multiplying summed percentage influence profiles by the summed base profile and standard influence profile to produce a forecast profile.

18. The method of claim 17, further comprising the step of:

summing the forecast profile with a seasonality influence profile describing a variation in demand resulting from a seasonal influence to produce an adjusted forecast profile.

19. The method of claim 15, wherein there is provided at least one standard influence profile having unit values, the step of combining the base profile and selected influence profiles comprises determining the forecast profile by the equation: ##EQU33## where m is a number of time intervals in the base profile;

n is a number of standard influence profiles;

standard.sub.-- profile is a standard influence profile; and,

base.sub.-- profile is the base profile.

20. The method of claim 19, wherein there is provided at least one percentage influence profile having percentage values, the step of combining the base profile with selected influence profiles further comprises determining the forecast profile with the equation: ##EQU34## where forecast.sub.-- profile is the forecast profile; and,

percent.sub.-- profile is a percentage influence profile.

21. The method of claim 19, wherein there is provided at least one seasonality influence profile, the step of combining the base profile with selected influence profiles further comprises determining the forecast profile with the equation: ##EQU35## where season.sub.-- pro is the seasonality influence profile.

22. The method of claim 15, the step of updating the base profile updating the base profile by its percent contribution to the total error comprises determining the updated base profile with the equation: ##EQU36## where base.sub.-- profile is the base profile prior to being updated;

profile.sub.-- weight is a weighting value specifying a percentage of the base profile to apply to the updated influence profile; and

delta.sub.-- profile is the percent contribution to the total error as a function of a difference between the actual current demand and the forecast profile, the difference bounded by a maximum and a minimum value for updating the base profile, and a ratio of the combined base profile and the at least one influence profile to a combined absolute value of the base profile and a combined absolute value of the at least one influence profile.

23. The method of claim 15, the step of updating each influence profile by its percent contribution to the total error comprises each influence profile with the equation: ##EQU37## where influence.sub.-- profile is an influence profile prior to being updated;

profile.sub.-- weight is a weighting value specifying a percentage of the influence profile to apply to the updated influence profile; and,

delta.sub.-- profile is the percent contribution to the total error as a function of a difference between the actual current demand and the forecast profile, the difference bounded by a maximum and a minimum value for updating the influence profile and a ratio of the influence profile to a combined absolute value of the base profile and a combined absolute value of the at least one influence profile.

24. The method of claim 22, wherein the delta profile is determined by the equation: ##EQU38## where base.sub.-- value is vector sum of the base profile and the at least one influence profile;

min.sub.-- update is the minimum value for updating the base profile;

profile.sub.-- sum is the combined absolute value of the base profile and the combined absolute value of the at least one influence profile; and,

delta is a vector based on the function of the difference between the actual current demand and the forecast profile, the difference bounded by a maximum and the minimum value for updating the base profile.

25. The method of claim 24, wherein the delta vector is set equal to the vector sum of a first vector determined by the equation: ##EQU39## and a second vector determined by the equation: ##EQU40## where actual.sub.-- dem is the actual demand for the business item in vector form;

forecast is the forecast profile; and,

max.sub.-- update is the maximum value for updating the base profile.

28. The method of claim 23, wherein the delta profile is determined by the equation: ##EQU43## where std.sub.-- pro is the at least one influence profile;

min.sub.-- update is the minimum value for updating the base profile;

profile.sub.-- sum includes the combined absolute value of the base profile and the combined absolute value of the at least one influence profile; and,

delta is a vector based on the function of the difference between the actual current demand and the forecast profile, the difference bounded by a maximum and the minimum value for updating the base profile.

29. The method of claim 28, wherein the delta vector is set equal to the vector sum of a first vector equal to: ##EQU44## and a second vector equal to: ##EQU45## where actual.sub.-- dem is the actual demand for the business item in vector form;

forecast is the forecast profile; and,

max.sub.-- update is the maximum value for updating the base profile.

31. The method of claim 16, wherein there is provided at least one standard influence profile having unit values, and at least one percentage influence profile having percentage values, the base profile is combined with selected influence profiles using the equation: ##EQU47## where: percent.sub.-- profile is a percentage influence profile;

standard.sub.-- profile is a standard influence profile;

m is a number of time intervals in the base profile;

n is a number of standard influence profiles; and

base.sub.-- value is determined by the equation: ##EQU48## where: standard.sub.-- profile is a standard influence profile; and,

base.sub.-- profile is the base profile.

32. The method of claim 31, wherein a weighted delta profile for the base profile is determined by the equation: ##EQU49## where: min.sub.-- update is the minimum value for updating the base profile;

profile.sub.-- sum includes the combined absolute value of the base profile and the combined absolute value of the at least one influence profile; and,

delta is a vector based on the function of the difference between the actual current demand and the forecast profile, the difference bounded by a maximum and the minimum value for updating the base profile.

33. The method of claim 32, wherein the delta vector is set equal to the vector sum of a first vector equal to: ##EQU50## and a second vector equal to: ##EQU51## where: actual.sub.-- dem is the actual demand for the business item in vector form;

forecast is the forecast profile; and,

max.sub.-- update is a maximum value for updating the base profile.

42. The method of claim 19, wherein the forecast profile is further determined by the equation: ##EQU61## where season.sub.-- pro is a seasonality influence profile defining variations in demand on a seasonal basis; and,

forecast.sub.-- pro is the forecast profile.

43. The method of claim 15, further comprising the steps of:

selecting influence profiles;

associating the selected influence profiles as a group; and,

combining the group of selected influence profiles with the base profile to create a

forecast profile.

44. The method of claim 15, wherein the step of storing in the memory at least one influence profile defining a variation in demand for the business item comprises the steps of:

specifying a business item;

specifying a plurality of time intervals for the influence profile;

specifying a weighting factor to be used to update the influence profile; and,

providing a data value for each time interval specified in the influence profile.

45. The method of claim 44, wherein the step of specifying a plurality of time intervals further includes:

specifying a beginning of a first time interval; and,

specifying a length of time for subsequent time intervals.

46. The method of claim 44, wherein the step of specifying a plurality of time intervals further includes:

specifying a beginning time of a first time interval;

specifying an ending time of a last time interval; and,

specifying a length of each time interval between the beginning time and ending time.

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L4: Entry 3 of 9 File: USPT Jan 27, 1998

US-PAT-NO: 5712985
DOCUMENT-IDENTIFIER: US 5712985 A

TITLE: System and method for estimating business demand based on business influences

DATE-ISSUED: January 27, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
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APPL-NO: 08/ 542847 [PALM]
DATE FILED: October 13, 1995

PARENT-CASE:
RELATED APPLICATION This application is a continuation in part of application Ser. No. 08/023,111, filed on Feb. 26, 1993, now U.S. Pat. No. 5,459,656 entitled BUSINESS DEMAND ESTIMATION SYSTEM, incorporated by referenced herein, which is a continuation in part of application Ser. No. 07/808,982, filed on Dec. 17, 1991, entitled PRODUCT DEMAND SYSTEM AND METHOD which is a continuation application of Ser. No. 07/406,069, filed on Sep. 12, 1989, entitled PRODUCT DEMAND SYSTEM AND METHOD, all of which are commonly owned by the assignee.

INT-CL: [06] G06 F 17/60

US-CL-ISSUED: 395/207; 395/210, 395/208, 364/468.01, 364/468.02, 364/468.03
US-CL-CURRENT: 705/7; 700/95, 700/96, 700/97, 705/10, 705/8

FIELD-OF-SEARCH: 395/208, 395/210, 395/207, 364/468.01, 364/468.02, 364/468.03

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected | Search ALL

	PAT-NO	ISSUE-DATE	PATENTEE NAME	US-CL
☐	4141069	February 1979	Fox	364/493
☐	5111391	May 1992	Fields et al.	395/209
☐	5224034	June 1993	Katz et al.	395/207
☐	5255181	October 1993	Chapman et al.	395/208
☐	5287267	February 1994	Jayaraman et al.	395/210
☐	5299115	March 1994	Fields et al.	395/210
☐	5440480	August 1995	Costanza	395/208
☐	5446890	August 1995	Renslo et al.	395/600
☐	5459656	October 1995	Fields et al.	395/207
☐	5615109	March 1997	Eder	395/207

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"Optimal production planning . . . " by Bartmann, D.; Oct. 1983 Acc. #02301025 file #2.

ART-UNIT: 241

PRIMARY-EXAMINER: Hayes; Gail O.

ASSISTANT-EXAMINER: Shingala; Gita

ATTY-AGENT-FIRM: Fenwick & West LLP

ABSTRACT:

A demand forecasting and production scheduling system and method creates production schedules for various business items describing a forecasted demand for the business items in a number of future time intervals. The system includes a computer managed database of various profiles, including a base profile for each business item, and a number of influence profiles. The profiles describe variations in demand for the business item in a number of time intervals. The base profile describes an underlying level of demand for a business item that is anticipated for the business item absent any influencing factors, such as promotional sales, holidays, weather variations, and the like. The variations in demand for the business item due to such influence factors are stored in the database as influence profiles. The influence profiles may be either standard, percentage, or seasonal. The forecasted demand for a business item in a number of future time intervals is determined by selective combination of the base profile for the business item and any number of influence profiles. The forecasted demand is stored in the database in a forecast profile. From the forecast profile a production schedule is created, and the business item provided according to the production schedule. Actual demand for the business item is monitored and stored. The variation between actual demand and the forecasted demand is used to update the base and influence profiles. From the updated base and influence profiles the forecasted demand is redetermined, and the production schedule updated accordingly.

48 Claims, 6 Drawing figures

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End of Result Set

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L2: Entry 1 of 1 File: USPT May 1, 1990

DOCUMENT-IDENTIFIER: US 4922435 A
**** See image for Certificate of Correction ****
TITLE: Food preparation robot

US Patent No. (1):
4922435

Detailed Description Text (6):
As configured in FIG. 1, a single fry cell 110 can handle and process french fries, chicken nuggets, fish filets, chicken patties, and individual portion sized pies, in sufficient quantities to handle the demands of most quick service restaurants, even during their highest peak hours. For example, the typical maximum combined capacity for the various types of foods (weight is on an uncooked basis) for fry cell 110 is shown in Table I.

Detailed Description Text (163):
FIG. 41 is a schematic block diagram illustrating various aspects of the computer control system of fry cell 110. The "Main Menu" is a display of a list of choices for the store manager to run and may include: (1) start fry cell 110; (2) review, modify, or correct the paremeters for fry cell 110; (3) make changes in basic data used in projecting the daily plan such as the product prices and product mixes; (4) entry of any detail that makes today a special day, such as community events that may inpact the demand placed on the store.

Detailed Description Text (171):
In operation of fry cell 110, the data contained by computer 616 together with the fry cell software operates to produce food at a rate that is based on the projected rate for that time of day from the historical data contained in computer 616. A plan of operation for the overall day is projected from the store opening to closing based on the historical sales data. This data is utilized by the system to generate a more detailed plan covering a shorter period of time, which may be an hour or less, such as a fifteen-minute period to produce product at the anticipated sales rate. The sales rate is set automatically on the basis of the daily plan for that day and can be increased or decreased by a human operator, for the entire day or for just a certain period, such as the lunch hour. A typical daily plan sales rate on an hourly basis is set forth in Table II.

Detailed Description Text (172):
A hypothetical product mix for the products which may be cooked by fry cell 110 on a percentage basis of dollar sales is set forth in Table III.

Detailed Description Text (174):
The hourly sales rate can be and is preferably further divided into a number of periods to more accurately follow actual sales rates. For example, the period from 10:00 a.m. to 1:00 p.m. is divided into 15-minute periods based on historical store data as shown in Table IV.

Detailed Description Text (178):
A command to robot 112 can consist of up to three parts: (1) a "cycle;" (2) a vat nubmer; and (3) a number of portions (required only for certain products such as fish filets and chicken patties). The various cycles are set forth in Table V.

Detailed Description Paragraph Table (1):
TABLE I FRY CELL CAPACITY Food Item Quantity/Hr. Baskets/Hr. french fries 100 lbs. 50 chicken nuggets 24 lbs. 12 fish filets 144 filets 12 chicken patties 96 patties 12 individually sized pies 128 pies or 8 (pies) or or hash browns 96 hash browns 12 (hash browns)

Detailed Description Paragraph Table (2):
TABLE II Typical Hourly Daily Plan Sales Rate Time Period Sales Rate ($ product/hr) 10:00-11:00 a.m. 350 11:00-12:00 Noon 650 12:00-1:00 p.m. 1100 1:00-2:00 p.m. 750 2:00-3:00 p.m. 500 3:00-4:00 p.m. 575 4:00-5:00 p.m 750 5:00-6:00 p.m. 900 6:00-7:00 p.m. 800 7:00-8:00 p.m. 700 8:00-9:00 p.m. 600 9:00-10:00 p.m. 500

Detailed Description Paragraph Table (3):
TABLE III HYPOTHETICAL PRODUCT MIX % Mix of Total Product Fry Cell Sales French Fries 40% Chicken Nuggets 30% Fish Filets 15% Chicken Patties 15% Total 100%

Detailed Description Paragraph Table (4):
TABLE IV Typical Quarter Hour Short-Term Plan Time Period Sales Rate ($ product/hr) 10:00-10:15 a.m. 50 10:15-10:30 a.m. 75 10:30-10:45 a.m. 100 10:45-11:00 a.m. 125 11:00-11:15 a.m. 125 11:15-11:30 a.m. 150 11:30-11:45 a.m. 175 11:45-12:00 Noon 200 12:00-12:15 p.m. 250 12:15-12:30 p.m. 300 12:30-12:45 p.m. 300 12:45-1:00 p.m. 250

Detailed Description Paragraph Table (5):
TABLE V Robot Command Cycles Cycle Description DROP (1) robot 112 picks up an empty fry basket from one of fry vats 146 to which it is assigned; (2) the fry basket is conveyed to dispensing station 120 by robot 112; (3) the dispenser is operated to fill the fry basket with a desired amount of food; and (4) the fry basket is conveyed back to its vat and set into the cooking fluid. PULL (1) robot 112 lifts the fry basket from the cooking fluid and allows it to drain; (2) the fry basket is conveyed to dump station 126 or transfer station 122; (3) dump station 126 or transfer station 122 is operated; (4) the empty fry basket is conveyed by robot 112 to its assigned location in one of fry vats 146. FETCH Food products such as fish filets and chicken patties are generally conveyed out of fry cell 110 via transfer station 122 for further processing and/or assembly. This cycle retrieves the empty fry baskets and places them back into fry cell 110 as follows: (1) the empty fry basket is conveyed back to fry cell 110 via transfer station 122; (2) robot 112 lifts the fry basket from transfer station 122; and (3) the fry basket is then conveyed back to its assigned fry vat 146. Computer 616 keeps track of which baskets have left fry cell 110 and the order in which they re-enter fry cell 110. SKIM (1) robot 112 picks up skimmer 442 and conveys it to one of fry vats 146; (2) robot 112 lowers skimmer 442 into fry vat 146 and draws it from back to front; (3) robot 112 lifts skimmer 442 and allows it to drain, then conveys it to waste container 448 for wiping on wiper 446; and (4) robot 112 conveys skimmer 442 to its holding bracket 444. FILL (1) robot 112 picks up fluid refill reservoir 432 and conveys it to a fry vat 146 to be filled; (2) robot 112 lowers reservoir 432 on activating mechanism 434; (3) after sufficient fluid is dispensed into fry vat 146, robot 112 lifts reservoir 432 from activating mechanism 434 and conveys reservoir 432 to its holding bracket. ENDRUN This cycle occurs only at the end of the day and initiates a shut-down procedure that consists of shutting down the equipment and emptying the dispensers.

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End of Result Set

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L3: Entry 1 of 1 File: USPT May 1, 1990

DOCUMENT-IDENTIFIER: US 4922435 A
**** See image for Certificate of Correction ****
TITLE: Food preparation robot

US Patent No. (1):
4922435

Detailed Description Text (143):
Computer operating and control station 128 can be configured to completely control the operation of fry cell 110. Preferably, as illustrated in FIG. 27, station 128 includes a fry cell master control computer 616, a sensing system consisting of various sensors and controllers as hereinafter described, a robot controller 620 for robot 112, a programmable logic controller (PLC) 622 and an operator input terminal 623 which includes a full function keyboard and a CRT display. Programmable logic controller 622 can be the General Electric Series One programmable controller (Series One PC). It uses micro-processor design and electronic circuitry to replace physical wiring, relays, push buttoms, limit switches, etc. It is programmed to execute instructions that control machines and process operations by implementing specific functions such as control logic, sequencing, timing, counting and arithmetic for such operations. The Series One PC replaces 4-100 relays, and any combination of up to 64 timers, counters and sequencers. It is also expandable from 8 to 112 I/O points and offers up to 1700 words of memory. The Series One PC outputs commands controlling product dispenser cycling and monitors dispenser product levels for robotized food processing.

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L4: Entry 4 of 9 File: USPT May 13, 1997

US-PAT-NO: 5630070
DOCUMENT-IDENTIFIER: US 5630070 A

TITLE: Optimization of manufacturing resource planning

DATE-ISSUED: May 13, 1997

INVENTOR-INFORMATION:

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Wittrock; Robert J.	Ossining	NY		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
International Business Machines Corporation	Armonk	NY			02

APPL-NO: 08/ 108014 [PALM]
DATE FILED: August 16, 1993

INT-CL: [06] G06 F 17/60

US-CL-ISSUED: 395/208
US-CL-CURRENT: 705/8

FIELD-OF-SEARCH: 364/401, 364/402, 304/41R, 304/402, 395/207-208, 395/210

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected | Search ALL

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
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"A Hybrid Approach to Multi-Objective Linear Optimization", Poh et al., Journal of the Operational Research Society, vol. 41, No. 11, 1990, pp. 1037-1048.
"A Weighted-Gradient Approach to Multi-Objective Linear Programming Problems Using the Analytic Hierarchy Process", Arbel, Mathematical and Computer Modelling, vol. 14, No. 4/5, 1993, pp. 27-39.
"Determination of the Crop Mix of a Rubber and Oil Plantation--A Programming Approach", Tan et al., European Journal of Operational Research, vol. 34, 1988, pp. 362-371.

ART-UNIT: 241

PRIMARY-EXAMINER: Hayes; Gail O.

ASSISTANT-EXAMINER: Kyle; Charles

ATTY-AGENT-FIRM: Perman & Green

ABSTRACT:

A method for constrained material requirements planning, optimal resource allocation, and production planning provides for an optimization of a manufacturing process by designating the amounts of various manufactured products to be produced, which products include both end products as well as subassemblies to be employed in the manufacture of one or more of the end products. In order to accomplish the optimization, the method employs an objective function such as the maximization of income in a situation wherein there are limitations on the inventory of raw materials and tools to be employed in the manufacturing process. Data describing

elemental steps in the manufacturing process for the production of each end product, as well as the quantity or demand for each end product which is to be supplied, are presented as a set of linear mathematical relationships in matrix form to be inserted in a computer which determines the optimum number of each end product in accordance with an LP optimization algorithm. The matrix contains bill of material data, and various constraints such as a constraint on the sum of products shipped and used as subassemblies, and constraints based on inventory, on available time for use of resources such as tools, and on inventory left over from an early production run for a later run.

23 Claims, 10 Drawing figures

L4: Entry 4 of 9 File: USPT May 13, 1997

DOCUMENT-IDENTIFIER: US 5630070 A
TITLE: Optimization of manufacturing resource planning

Abstract Text (1):
A method for constrained material requirements planning, optimal resource allocation, and production planning provides for an optimization of a manufacturing process by designating the amounts of various manufactured products to be produced, which products include both end products as well as subassemblies to be employed in the manufacture of one or more of the end products. In order to accomplish the optimization, the method employs an objective function such as the maximization of income in a situation wherein there are limitations on the inventory of raw materials and tools to be employed in the manufacturing process. Data describing elemental steps in the manufacturing process for the production of each end product, as well as the quantity or demand for each end product which is to be supplied, are presented as a set of linear mathematical relationships in matrix form to be inserted in a computer which determines the optimum number of each end product in accordance with an LP optimization algorithm. The matrix contains bill of material data, and various constraints such as a constraint on the sum of products shipped and used as subassemblies, and constraints based on inventory, on available time for use of resources such as tools, and on inventory left over from an early production run for a later run.

Application Filing Date (1):
19930816

Brief Summary Text (4):
Resource allocation decisions are typically subject to constraints such as limitations in availability of materials, equipment, time, cost, and other parameters affecting the outcome of a technological process, as well as the utility of a particular resource in a particular application. As an example of particular interest herein, there is need to optimize the MRP for production of products, such as semiconductor devices, particularly in a situation wherein plural intermediate products must be formed first during various time frames for subsequent combination to provide the end product. Each particular allocation of resources can be associated with a specific result such as the cost or number of products produced. Ideally, resources should be allocated so as to satisfy all of the constraints and, simultaneously, to maximize a resulting benefit, such as by minimizing the costs or by maximizing the number of devices outputted by a manufacturing process.

Brief Summary Text (6):
A problem arises in that present systems and methodology for processing MRP procedures are limited to a prediction of the amount of products, such as semiconductor devices, to be outputted from a manufacturing facility for a given set of input parameters, such as amounts of various raw materials, available equipments and available time, for a succession of manufacturing steps. The presently available systems and methodology are unable to perform an optimization process for MRP, based on a linear objective function such as minimization of cost or maximization of the number of outputted devices. Thus, at the present time, a manufacturer can guess at a possible set of input parameters which might produce a near optimum result, and apply this to an MRP system which would predict the outcome. But there are no assurances that the predicted outcome would be near optimum.

Brief Summary Text (8):
Presently available MIS is directed primarily to data management systems. Most important manufacturing decisions (for example, what to make, how much to make, when

and where to make [redacted]) are ultimately made by humans [redacted]ather than by an MIS. Typically, a manufacturer uses intuition and experience together with knowledge about manufacturing capacity and market demand to determine an initial production plan. Then the manager would run MRP and/or CRP to produce reports describing inconsistencies between a production plan and availability of a resource. This would be followed, possibly, by a revision of the production plan with a rerun of the MRP and the CRP. This is time consuming, and the reports are difficult to interpret for purposes of revising a production plan so as to alleviate a shortage of a particular material employed in the production process. An attempt to run an infeasible production plan can result in missed customer shipments, excess raw material inventory, long cycle times, production bottlenecks, poorly utilized capacity, and idle workers. Even when the production plan is feasible, the manufacturer must deal with the lengthy process of manually revising the production plan until receipt of a report from MRP and CRP indicating no shortages. The process can result in poor resource allocation decisions, such as the allocation of scarce resources to low profit products.

Brief Summary Text (16):
In accordance with a feature of the invention, the matrix contains: (1) BOM data in the situation wherein a lack of material inventory provides a constraint, (2) a statement in the form of a constraint for each end product that the sum of the quantity of an end product supplied plus the quantity of the end product employed as a subassembly cannot exceed the quantity of the end product which may be available from inventory plus the quantity produced in the manufacturing process, (3) a statement in the form of a constraint for each product, including subassemblies, that the quantity of a product supplied cannot exceed the quantity of the product which may be available from inventory plus the quantity produced in the manufacturing process, (4) a statement in the form of a constraint for each product that the quantity of a product to be shipped cannot exceed the quantity which is desired, and (5) production of each product and shipment of each product cannot be less than zero. This matrix is referred to as the A matrix. Also, on the right hand side of the A matrix is a vector, referred to as the b vector, containing data as to the amount of items, both end products and raw materials, in inventory plus the demand for each end product. The foregoing contents of the A matrix and the b vector reflect a simple situation wherein there are adequate resources so that there is no resource constraint. In the case wherein a lack of resources imposes a constraint, then there are additional statements including BOR data and constraints in the use of the resources, such as the amount of time available for use of a resource.

Detailed Description Text (3):
In operation, silicon slabs are inputted to the system 20, are coated with photoresist at one of the vacuum chambers 30 or 32, are transported to the stepper 56 to be exposed to the light for production of images in the photoresist. In further steps of the manufacture, the wafers are transported among the wash stations 34, 36, the vacuum chambers 30, 32 and the photolithographic station 28 to accomplish well-known semiconductor circuit fabrication steps such as the washing away of exposed photoresist, the deposition of dopants, further deposition of resist and exposure to lithography, and etching away of portions of layers of materials deposited in the vacuum chambers 30 and 32. Manufacturing steps requiring heating for a prescribed interval of time are accomplished by transporting the wafers 26 to one of the ovens 38 and 40. Upon completion of the construction of a wafer 26, the wafer 26 is transported to one of the slicing stations 42 or 44 to separate the various chips 22, some of which are dispensed directly as end products, and other ones of which serve as subassemblies to be employed in the assembly of a module 24.

Detailed Description Text (4):
To facilitate demonstration of the invention, the system 20 is portrayed partially in two channels which share a common photolithographic station 28 and a common assembly station 46. Thus, there is a time sharing of the stepper 56 among wafers 26 produced by the upper channel comprising the chamber 30, the oven 38 and the slicing station 42, and wafers 26 produced by the lower channel comprising the chamber 32, the oven 40 and the slicing station 44. While two wash stations 34 and 36 are shown, respectively, in the upper channel and the lower channel, it is possible, alternatively, to construct the system 20 with a single wash station shared between the two channels. Implementation of the invention takes into account a time sharing of resources between the two channels so as to meet an objective function such as minimization of cost or maximization of income. The use of the two channels is convenient for operation of the assembly station 46 by bringing simultaneously chips 22 of the upper and the lower channels to facilitate the assembly process, and to

minimize production time for the modules 24.

Detailed Description Text (6):
The operation of the invention will be explained hereinafter by a mathematical description. However, in order to facilitate explanation of the invention, a manufacturing operation simpler than that of the foregoing semiconductor circuit fabrication will be presented. Accordingly, the ensuing description makes reference to a restaurant producing various forms of omelets and sandwiches from a limited inventory of raw ingredients consisting of peppers, mushrooms, butter, eggs, ham, cheese and bread. Also included in the inventory, by way of example, are a few plain sandwiches each of which consists of two slices of bread, and a single previously prepared cheese sandwich. The quantities of the various ingredients and the selling prices of the various products are presented in the following description. In order to make an analogy between the production of omelets and sandwiches with the foregoing manufacture of semiconductor circuits, it will be assumed that a plain omelet can be served directly to a customer, or that the plain omelet can serve as a subassembly in the production, or manufacture, of a more complex omelet, such as a cheese omelet wherein further preparation cooking time is employed to incorporate the cheese. Similar comments apply to other more complex types of omelets and to the various forms of sandwiches as will be described.

Detailed Description Text (7):
Upon completion of the description of the preparation of the various omelets and the sandwiches, the description continues with the arrangement of the various raw materials plus inventory constraints, and other constraints of the invention, within a matrix format for insertion into a computer to perform LP optimization. The optimization attains the numbers, or quantities of the various omelets and sandwiches which meet an objective function, herein in this example, a maximization of income to the restaurant. Further examples are given to demonstrate constraints due to lack of a sufficient number of restaurant tools such as toasters and skillets, and also to demonstrate the procedure of the invention for the situation wherein the preparation of the food extends over two intervals of time, such as early and late lunch, wherein there may be a delivery of raw ingredients after the early lunch to supplement the inventory left over from the early lunch. This is then followed by the mathematical description.

Detailed Description Text (8):
In the ensuing description of the preparation of food products by the restaurant, tabulated data for the various forms of the omelets and the sandwiches will be presented in a set of tables wherein Table 1 presents the cost or selling price for each food item outputted by the manufacturing process, as well as recipes for each food item. The recipes are set forth in a format analogous to a manufacturing process employing raw materials plus previously completed subassemblies. For example, the vegetable omelet is described as being composed of raw materials, namely two ounces of mushrooms and two ounces of green peppers, plus a single subassembly, namely one plain omelet. To calculate the total amount of raw materials consumed in the production of the vegetable omelet, one must consider both the raw materials listed in the recipe plus the raw materials employed in producing the subassembly of the plain omelet; this gives two ounces of mushrooms, two ounces of green peppers, three eggs, and one teaspoon of butter. Such a break-out of the amounts of all of the raw materials employed in production of an end product, often referred to as an explosion in the language of MRP, is employed in listing the total amount of each ingredient, or raw material, as will be described with reference to Table 4, to meet the demands by customers for various food products as set forth in Table 2.

Detailed Description Text (10):
In order to illustrate the differences between standard MRP and constrained production planning, there is provided the following relatively simple example. A cook makes 2 types of foods, omelets and sandwiches. He makes 5 types of omelets and 5 types of sandwiches, using a total of 7 ingredients (eggs, bread, butter, ham, cheese, peppers and mushrooms). He has a set of customer orders for his omelets and sandwiches and a fixed set of ingredients on hand. The receipts, and the selling price of his products are shown in Table 1.

Detailed Description Text (67):
In the foregoing example in the preparation of omelets and sandwiches, constraints were placed on inventory of food materials. The example is now extended to include a bill of resources wherein constraints are present also on availability of equipment

used in preparation of the food products. Therefore, in addition to the materials (e.g., food) we now also consider the availability of two resources, skillets and a toaster.

Detailed Description Text (69):
The total requirements for these resources are computed using logic similar to Bill-of-Material explosion. Note that a cheese omelet requires a total of 6 minutes of skillet time, 3 in the "subassembly" process of making the plain omelet, and 3 in the final assembly process of making the cheese omelet from the cheese and plain omelet.

Detailed Description Text (72):
The first inequality in (6) says that the total time for which the skillets are used does not exceed the total time for which the skillets are available (90=6.times.15). The second inequality says that the total time required by the toaster does not exceed the time available on the toaster.

Detailed Description Text (73):
Note that the optimal solution to the previous LP with constraints (1)-(5) uses 76 minutes of skillet time and 24 minutes of toaster time, and therefore it is not feasible with respect to the resource availability constraints (6).

Detailed Description Text (86):
These assumptions are realistic in many manufacturing companies. As an illustration, we continue the food example, but restrict ourselves to only the sandwiches. We consider 2 time periods, say an early lunch period and late lunch period, and we assume that a delivery of raw materials arrives between the two lunch periods.

Detailed Description Text (94):
Notice that the extra cheese remaining at the end of the early lunch period (6=30-24) is used in the later lunch period (6+20-30=10), so that the late lunch period net requirement for cheese is only 10, rather than 16. In contrast, the extra time available for the toaster in the early period cannot be used in the late lunch period.

Detailed Description Text (113):
The linear programming model requires material availability constraints for each part number in each time period, and service (shipment) accumulation constraints for each demand and each time period.

Detailed Description Text (114):
For the first time period the constraints take the form ##STR2##

Detailed Description Text (147):
Require variable x.sub.jt if j is the part number of a product (has a bill of material and/or a bill of resources) and it is a period of time in which part number j can be completed.

Detailed Description Text (189):
Utilization of the invention, generally, involves production planning and is concerned with determining production and stock levels to meet fluctuating demand requirements. If resources can be acquired as needed and plant capacity is infinitely expandable and contractible at no cost, then the optimal production schedule consists of producing end products according to the demand schedule, and producing subassemblies (i.e., intermediate products) exactly when needed as input to next assembly process. However, in many real assembly systems, the supply of some raw materials is tightly constrained, with long production and/or procurement lead-times. The demand for products fluctuates, both in total volume and in product mix. As a result, just-in-time production is not usually feasible, and when feasible, may result in poor utilization of resources. This tool provides methods for determining the best utilization of the available resources, given the current forecast of demand requirements.

Detailed Description Text (190):
Since both the inventory balance equations and the profit maximization objective function are linear (see formulation below), it is not surprising or new to consider linear programming approaches to resource allocation problems. Several "textbook" formulations have been published. However, the inventory management literature cautions against the use of linear programming for resource planning because of the

difficulty of accurately formulating the allocation problem for a multi-level assembly process, because of the size and complexity of the formulation for even simple single level assembly processes, and because of the difficulty of interpreting and implementing the solution of the linear program. Recent improvements in LP software packages and computing hardware have rendered the size considerations less forbidding; it is now possible to solve realistic problems in a reasonable amount of time. For example, on an RS/6000, the LP corresponding to a real production planning problem for 400 part numbers, 500 demands, and 26 weeks, can be solved in under 10 minutes cpu time. This invention addresses the remaining considerations: accurately formulating the allocation problem, and enabling effective use of the results by inventory managers.

Detailed Description Text (233):
In real assembly processes, it may take several periods to produce a product, and the product may require materials (p/n s) and resources in each of these periods. Such considerations can easily be included in the above formulation by keeping track of the release period of each product, the period when each input material or resource is required, and the completion period. The time indices t in the above constraints are appropriately modified.

Detailed Description Text (234):
Let m(j) denote the manufacturing lead time (rounded to an integer number of model periods) of p/n j. That is, if one begins the manufacturing process for a single unit of p/n j in period t, that unit of p/n j will be complete in period t+m(j).

Detailed Description Text (237):
Incorporating these manufacturing lead time and offset considerations into the constraint matrix requires the following modification of the material balance and resource availability constraints. ##EQU20##

Detailed Description Text (238):
Note that the subscripts indicating the time index of the x variables have been changed.

Detailed Description Text (242):
Similarly, the inventory balance constraints can be modified to consider the time-sensitive part or resource usage resulting from engineering and/or technology changes.

Detailed Description Text (243):
Often bill-of-material and bill-of-resources information includes effectivity date information. That is, a p/n, say i, may be used to build another p/n, said j, only during a specific interval, say periods t.sub.1, t.sub.1 +1 . . . . , t.sub.1 +t.sub.2. In all other manufacturing periods, p/n i is not required for the production of p/n j.

Detailed Description Text (289):
In addition to substitute parts, a simple extension of the resource allocation model allows for consideration of the possibility of building a part according to more than one bill-of-material or bill-of-resources. For example, certain types of memory modules can be built using one "all good" chip and a corresponding substrate, or using two "half-good" chips, and their corresponding substrate. The resource allocation tool can be used to determine how many of each product should be built in each time period using each possible BOM and/or BOR.

Detailed Description Text (304):
The sum ##EQU42## is the total usage of p/n j in time period t in all BOMs.

Detailed Description Text (355):
1. Demand data: can include backlogged orders, accepted orders, planned orders, and forecasted orders.

Detailed Description Text (374):
5. A method for critical components constrained Material Requirements Planning where by a specified set of critical raw materials(for example, components with long lead times, or limited availability) are allocated to demands so as to maximize profit, and the resulting production plan (shipment schedule per demand and period, production schedule per production and period) is then analyzed to determine the requirements of all materials not in the specified set.

Detailed Description Text (375):
Specifically, in Step 1, demand data, bill-of-material data, inventory data, and cost and revenue data are extracted from an MRP system. In a subsequent step (Step 1a) the bill-of-material data is processed to eliminate from each bill-of materials all raw material part numbers which are not in the pre-specified set of critical parts, and all product part numbers which do not use, either directly or on subassemblies, raw materials in the pre-specified set of critical parts. A resulting "stripped" bill-of materials may have no component parts. Inventory data for raw material part numbers which are not on the pre-specified critical parts list and have demand are replaced by the total demand for that part number in each time period. In Step 2, the Optimal Resource Allocation Procedure processes the reduced set of data produced by Step 1a and formulates the Linear Program corresponding to the reduced set of data. A product which has no component parts on its bill-of-materials results in production variables which are unconstrained, that s, they can take arbitrarily large values. The shipment variables corresponding to these products will exactly equal demand. Step 2 then invokes an LP solver, extracts the optimal values of the LP variables, translates these values in to a shipment schedule and a production schedule. Then, in Step 3, the shipment schedule and the production schedule are inserted into the MRP system. The MRP then uses the original set of bill-of-materials data, the shipment schedule, and the production schedule to determine the requirements of all of the part numbers. In an alternate implementation of this method, the bill-of-material pre-processing (Step 1a) is omitted. Subsequent to Step 1 in Step 1b the inventory data for every raw-material not on the per-specified critical component list, the inventory data is replaced by the vector (M,M,M, . . . ,M) where M is some very large quantity (e.g., expected total annual part usage). This results in that part usage constraints for these parts having extremely large right-hand-sides. In effect, the constraint has been omitted from the formulation. Decision variables that appear only in these constraints become unconstrained.

Detailed Description Text (379):
Specifically, in Step 1, demand data, bill-of-material data, and inventory data are extracted from an MRP system or other manufacturing information, bill-of-resource data and resource availability data are extracted from a CRP system or other manufacturing information system, and cost and revenue data is extracted from the MRP system, the CRP system, or some other manufacturing information system. The demand data includes previously accepted orders, the specified new order, and a forecast of future orders. Each order is classified according to its type. The due date for the new order is set to the current date, and it is given a high revenue value-higher than the total value of the forecasted orders. In Step 2, the Optimal Resource Allocation Procedure processes this data and formulates the Linear Program. This LP includes shipment bounds, reflecting the fact that the previously committed orders must be shipped on their respective due dates. Then the LP solver is invoked, and the optimal values of the LP variables are extracted and translated in to a shipment schedule and a production schedule. The date at which the new order ships is the earliest possible date at which this order can be shipped. This date is reported to the user, or returned to the MRP system or other manufacturing information system.

Detailed Description Text (380):
8. A method for New Order Assessment in which a set of previously accepted orders, information on shipment revenue and late delivery penalties associated with these orders, a specified new order, shipment revenue associated with shipping this order in each time period, material availability information, and capacity availability information are analyzed to determine whether it is profitable for the manufacturing company to accept the specified order, the most profitable ship date for the order, and the impact on the ship dates of previously accepted orders. This method allocates material and capacity to the set of previously accepted orders and the specified new order in a manner that optimizes the total profit. The resulting shipment schedule is reviewed to determine (1) whether the specified new order is ship, (2) the shipment date of the specified new order, and (3) the shipment dates of the previously accepted orders.

Detailed Description Text (381):
Specifically, in Step 1, demand data, bill-of-material data, and inventory data are extracted from an MRP system or other manufacturing information system, bill-of-resource data and resource availability data are extracted from a CRP system or other manufacturing information system, and cost and revenue data is extracted

from the MRP syst the CRP system, or some other manufacturing information system. The demand data includes previously accepted orders, the specified new order, and a forecast of future orders. Each order is classified according to its type. Revenue data for forecasted orders is scaled by the probability of the order materializing. The due date for the new order is set to the current date. In Step 2, the Optimal Resource Allocation procedure processes this data and formulates the Linear Program. This LP includes shipment bounds, reflecting the fact that the previously committed orders must be shipped on their respective due dates. Then the LP solver is invoked, and the optimal values of the LP variables are extracted and translated in to a shipment schedule and a production schedule. If the new order does not appear on the shipment schedule, then it is not profitable to make the order and it should be rejected, or the customer's price should be increased so that the order becomes profitable. If the new order does appear on the shipment schedule, then the date at which the new order ships is the most profitable date at which this order can be shipped. If earlier shipment is desired, the customer price can be increased. The shipment status of the new order, and, if appropriate, the shipment date date are reported to the user, or returned to the MRP system or other manufacturing information system.

Detailed Description Text (383):
Specifically, the method described in Ex. 3 is used, with time periods set to a day or a shift, rather than than the usual planning period duration of a week or a month.

Detailed Description Text (389):
Specifically, in Step 1, demand data, bill-of-resource data, resource availability data, and cost and revenue data are extracted from a CRP system, or from an other manufacturing information system. The parallel assembly lines are represented as substitutes on the bill-of-resources. This method uses substitute resources on the bill of substitution data structure to define candidate assembly lines or processes for each product. Processing times can be different for same product on different lines. The cost of unused production capacity can be weighted so as to achieve the desired level of balance between the parallel lines or processes. In Step 2, the Optimal Resource Allocation Procedure processes this data, formulates the Linear Program, invokes an LP solver, extracts the optimal values of the LP variables, translates these values in to a shipment schedule, a production schedules, and a resource usage schedule. The resource usage schedule gives the allocation of products to assembly lines.

Detailed Description Text (393):
Specifically, in Step 1, demand data, bill-of-material data, and inventory data are extracted from an MRP system or other manufacturing information system, bill-of-resource data and resource availability data are extracted from a CRP system or other manufacturing information system, and cost and revenue data is extracted from the MRP system, the CRP system, or some other manufacturing information system. In Step 2, the Optimal Resource Allocation Procedure processes this data, formulates the Linear Program, invokes an LP solver, extracts the optimal values of the LP variables, translates these values in to a shipment schedule and a production schedule. In addition, the "dual variable" are also extracted from the LP solver, and those corresponding to material availability constraints and capacity availability constraints are sorted in decreasing order. Among this set, the constraint with the largest dual variable corresponds to a capacity or material, and a time period such that obtaining more of that capacity or resource in that time period will have the greatest impact on total profit. A list of pairs (material or resource, time period) that have the most potential for impacting profit are reported.

Detailed Description Text (397):
Specifically, in Step 1, data describing the demand, inventory, bill-of-materials, bill-of-resources, capacity availability, cost and revenue, and bill-of-products is extracted from MRP, CRP and other manufacturing information systems. There may be multiple bill-of-materials and/or multiple bill-of-resources for each product; each bill-of-materials and bill-of-resources may have a distinct cost associated with it. This cost data is included in the cost and revenue data. In Step 2, the Optimal Resource Allocation Procedure processes this data and formulates the Linear Program. There are multiple production variables for each product, corresponding to each of the possible bill-of-materials and bill-of-resources associated with that product. Then the LP solver is invoked, and the optimal values of the LP variables are extracted and translated into a shipment schedule and a production schedule. The

production schedu specifies the quantity of each oduct built with each bill-of-materials and each bill-of-resources in each time period. In Step 3, the shipment schedule and the production schedule are inserted to the MRP system, the CRP system, and the other manufacturing information system.

Current US Original Classification (1):
705/8

CLAIMS:

8. A method according to claim 7 wherein said manufacture is accomplished with the use of a set of resources, each resource of said set of resources being available for a predetermined amount of time, the method further comprising

establishing additional resource-constraint rows in said matrix and corresponding additional resource-constraint locations in said vector;

for each of the products employing, in its manufacture, one of said resources, totaling the usage time for each product of said one resource, and setting forth a relationship in the matrix row of said one resource providing for said totaling of resource usage time, said totaling of resource usage time being less than or equal to a maximum amount of resource usage time set forth in the corresponding resource constraint location of said vector.

9. A method according to claim 8 wherein said manufacture extends over a plurality of time periods, and said material constraint applies to a first of said periods, the method further comprising steps of

establishing an additional material constraints for additional ones of said periods; and

modifying all of said material constraints by adding an additional set of columns to the matrix, equal in number to the number of said periods, to designate a carry-over amount of a component to be carried over from a previous one of the periods for use in a subsequent one of the periods, the carry-over amount being zero in the case of manufacture accomplished in the first period.

10. A method according to claim 1 wherein said manufacture is accomplished with the use of a set of resources, each resource of said set of resources being available for a predetermined amount of time, the method further comprising

establishing additional resource-constraint rows in said matrix and corresponding additional resource-constraint locations in said vector;

for each of the products employing, in its manufacture, one of said resources, totaling the usage time for each product of said one resource, and setting forth a relationship in the matrix row of said one resource providing for said totaling of resource usage time, said totaling of resource usage time being less than or equal to a maximum amount of resource usage time set forth in the corresponding resource constraint location of said vector.

11. A method according to claim 1 wherein said manufacture extends over a plurality of time periods, and said material constraint applies to a first of said periods, the method further comprising steps of

establishing an additional material constraints for additional ones of said periods; and

modifying all of said material constraints by adding an additional set of columns to the matrix, equal in number to the number of said periods, to designate a carry-over amount of a component to be carried over from a previous one of the periods for use in a subsequent one of the periods, the carry-over amount being zero in the case of manufacture accomplished in the first period.

12. A method according to claim 11 wherein said manufacture requires a lead time for one or more of said products, there being a further step of offsetting a manufacturing procedure of said one product to a latter one of said plurality of periods, and a step of displacing said product variable in said matrix from a row of said first period to a row of a latter period.

22. A method for material constrained production planning whereby a feasible allocation of material to demand for maximization of profit is determined to obtain an optimum production quantity for each of said product types, the material including components in a plurality of manufacturing procedures conducted in accordance with a manufacturing information system for said optimum production quantity, the method comprising steps of:

providing demand data, bill-of-resource data, resource availability data, cost and revenue data;

within each of said procedures, establishing quantities of components to be employed in respective ones of said procedures;

providing an inventory of said components from said data, and placing each type of component of the inventory in a separate location of a vector;

arranging said products as variables in respective product columns of a matrix having rows and columns wherein individual ones of the rows are reserved for respective components of the products, there being a plurality of product columns with a separate column for each product type;

establishing a material constraint for the set of components of the respective component rows by, in each of the component rows, multiplying the product variable of each column by coefficients designating the amount of each component in the product, each of the component rows corresponding to the location of an amount of component type in the vector;

via a plurality of production constraints for said products, constraining shipments of respective ones of said product types minus the quantity of each of the respective product types produced to be less than or equal to a quantity of each of the product types in inventory;

placing said production constraints of said product types in respective ones of additional rows of the matrix with shipments being located in separate shipment columns of the matrix and said product types being located in the respective product columns, there being a separate row for each product type having a nonzero shipment, the quantities of the product types in inventory being entered at locations of said vector corresponding to the matrix row having the production constraints;

via a plurality of demand constraints for said products, constraining shipments of respective ones of said product types to be less than or equal to a demand for the respective product types;

placing said demand constraints of said products in separate additional rows of said matrix with shipments being located in respective ones of said shipment columns of the matrix, the demands for said product types being located in separate locations of said vector corresponding to the respective rows of the demand constraints;

wherein said manufacture is accomplished with the use of a set of resources, each resource of said set of resources being available for a predetermined amount of time, the method further comprising

establishing additional resource-constraint rows in said matrix and corresponding additional resource-constraint locations in said vector;

for each of the products employing, in its manufacture, one of said resources, totaling the usage time for each product of said one resource, and setting forth a relationship in the matrix row of said one resource providing for said totaling of resource usage time, said totaling of resource usage time being less than or equal to a maximum amount of resource usage time set forth in the corresponding resource constraint location of said vector;

applying a linear programming optimization to said matrix and said vector in accordance with an objective function to obtain said optimum production quantity for each of said product types to maximize profit;

providing a shipment schedule and a production schedule; and

inserting the shipment schedule and the production schedule into said manufacturing information system for a manufacture of each of said product types in said optimum production quantity.

23. A method for critical components constrained materials requirements planning whereby a specified set of critical raw materials are allocated to demands to obtain an optimum production quantity for each of said product types so as to maximize profit, and the resulting production plan is then analyzed to determine the requirements of all materials not in the specified set, the critical raw materials including components in a plurality of manufacturing procedures conducted in accordance with a manufacturing information system for said optimum production quantity, the method comprising steps of:

extracting demand data, bill-of-material data, inventory data from a manufacturing information system;

eliminating from each bill-of-materials all raw material part numbered units which are not in a predetermined set of critical parts, and all product part numbered units which do not use, either directly or on subassemblies, raw materials in the predetermined set of critical part, thereby to provide a reduced bill of materials;

replacing inventory data for raw material part numbered units which are not on the predetermined critical parts list and which have demand by a total demand for respective ones of the part numbered items in each of a plurality of time periods;

within each of said procedures, establishing quantities of components to be employed in respective ones of said procedures;

providing an inventory of said components, and placing each type of component of the inventory in a separate location of a vector;

arranging said products as variables in respective product columns of a matrix having rows and columns wherein individual ones of the rows are reserved for respective components of the products, there being a plurality of product columns with a separate column for each product type;

establishing a material constraint for the set of components of the respective component rows by, in each of the component rows, multiplying the product variable of each column by coefficients designating the amount of each component in the product, each of the component rows corresponding to the location of an amount of component type in the vector;

via a plurality of production constraints for said products, constraining shipments of respective ones of said product types minus the quantity of each of the respective product types produced to be less than or equal to a quantity of each of the product types in inventory;

placing said production constraints of said product types in respective ones of additional rows of the matrix with shipments being located in separate shipment columns of the matrix and said product types being located in the respective product columns, there being a separate row for each product type having a nonzero shipment, the quantities of the product types in inventory being entered at locations of said vector corresponding to the matrix row having the production constraints;

via a plurality of demand constraints for said products, constraining shipments of respective ones of said product types to be less than or equal to a demand for the respective product types;

placing said demand constraints of said products in separate additional rows of said matrix with shipments being located in respective ones of said shipment columns of the matrix, the demands for said product types being located in separate locations of said vector corresponding to the respective rows of the demand constraints; and

applying a linear programming optimization to said matrix and said vector in accordance with an objective function to obtain said optimum production quantity for each of said product types to maximize profit;

providing a shipment schedule and a production schedule; and

inserting the shipment schedule and the production schedule into said manufacturing information system for a manufacture of each of said product types in said optimum production quantity.